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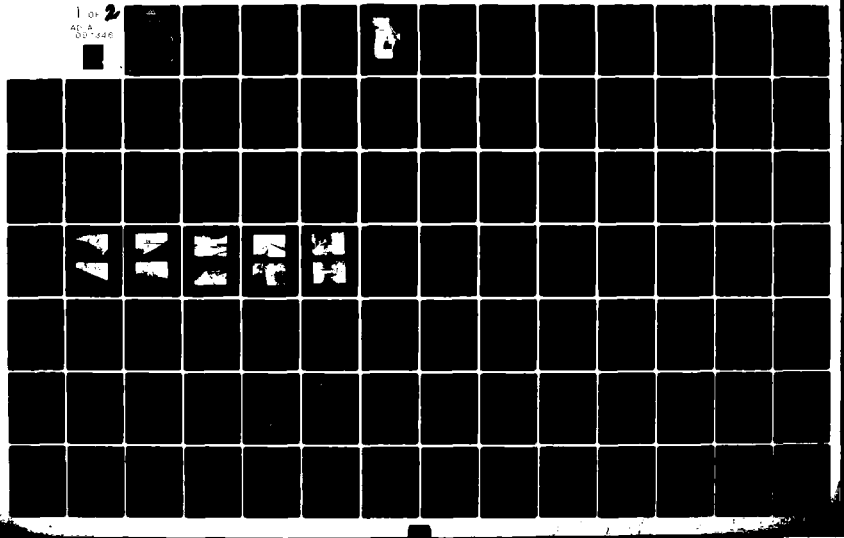

LEVEL II

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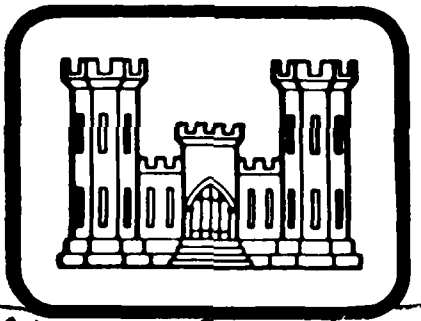
(6) SUSQUEHANNA RIVER BASIN
National Dam Inspection Program,
LAKE LEHMAN DAM
~~P. H. GLATFELTER COMPANY~~

(NDI ~~NO.~~ Number PA-00341
DER ~~NO.~~ Number 67-480), Susquehanna River Basin,
YORK COUNTY, PENNSYLVANIA.
PHASE I INSPECTION REPORT,
NATIONAL DAM INSPECTION PROGRAM



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PREPARED FOR
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

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Harrisburg / Pennsylvania
BY
Berger Associates
Harrisburg, Pennsylvania 17105

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PREFACE

This report has been prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITIONS
AND RECOMMENDATIONS

Name of Dam:	LAKE LEHMAN DAM
State & State No.:	PENNSYLVANIA, 67-480
County:	YORK
Stream:	POWDER MILL RUN, TRIBUTARY TO CODORUS CREEK
Date of Inspection:	October 9, 1980

Based on the visual inspection, past performance and the available engineering data, the dam and its appurtenant structures appear to be in good condition.

In accordance with the Corps of Engineers' evaluation guidelines, the size classification of this dam is intermediate and the hazard classification is high. These classifications indicate that the Spillway Design Flood (SDF) should be the Probable Maximum Flood (PMF). The spillway capacity is adequate for passing 43 percent of the PMF peak inflow without overtopping the dam. The spillway, therefore, is considered to be inadequate, but not seriously inadequate.

~~The following~~ recommendations ~~are~~ presented for immediate action by the owner:

1. That measures shall be taken to provide an adequate spillway capacity, which shall include the raising of the embankment profile uniformly to at least its design crest elevation;
2. That the downstream toe and an area 20 feet beyond the toe be cleared on a regular basis of all brush, weeds and trees, permitting close observation of the seepage;
3. That the slab joints in the spillway channel be filled with a joint material.
4. That the seepage be monitored on a regular basis. If turbidity or an increase in flow is detected, immediate action shall be taken to correct this condition.

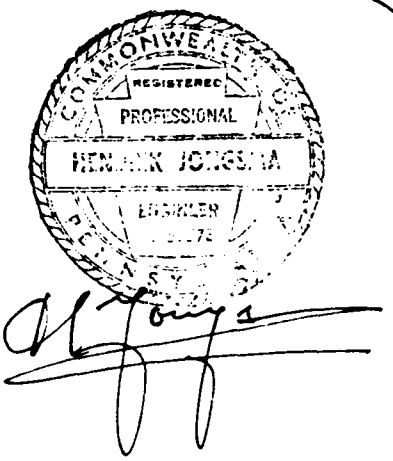
5. That close observation be maintained of the tilted walls in the spillway. If additional movement is recorded, measures shall be taken to correct this condition.

6. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.

SUBMITTED BY:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

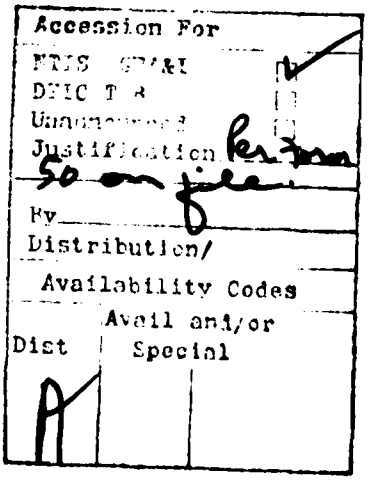
DATE: February 9, 1981

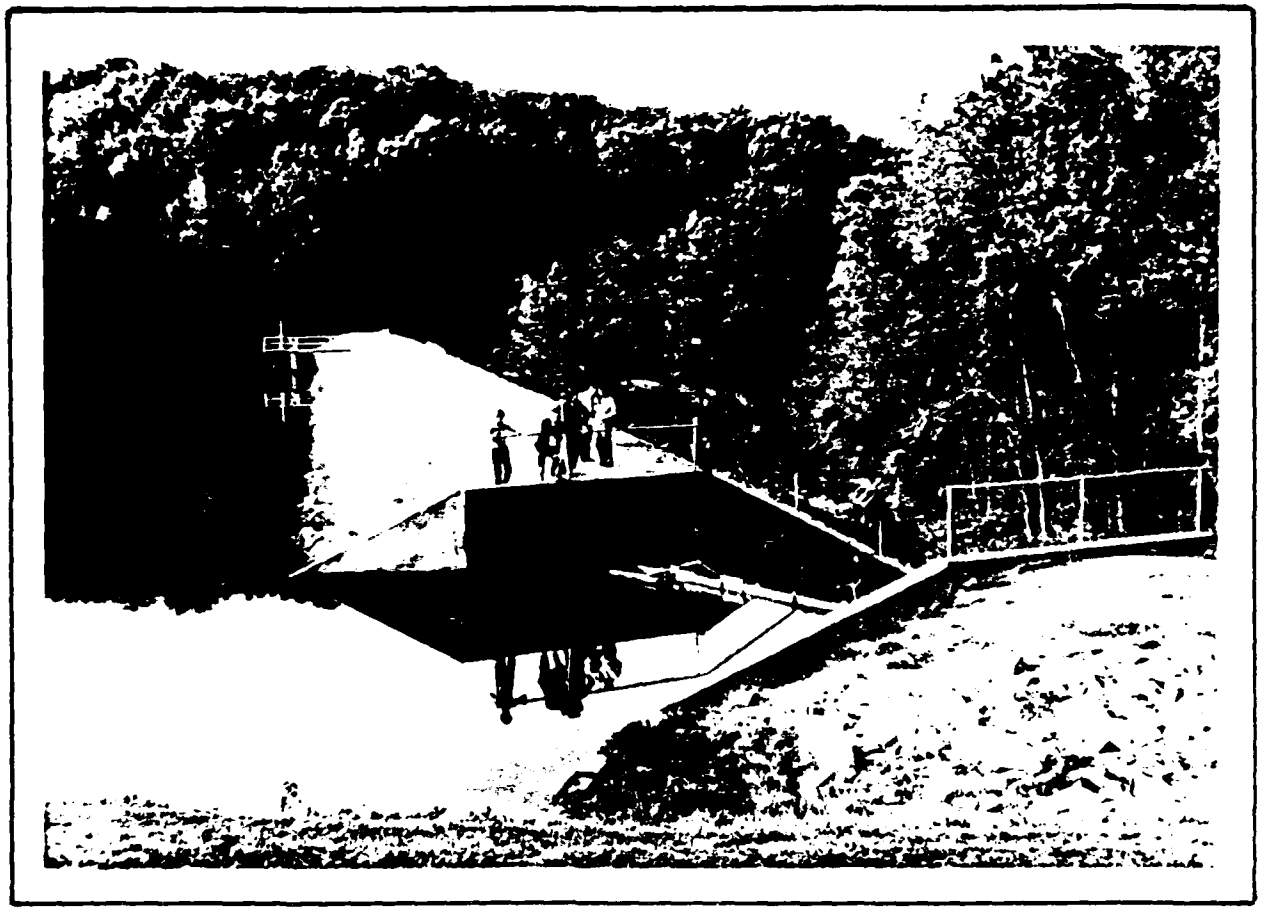


APPROVED BY:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

DATE: 4 MARCH 81





OVERVIEW

LAKE LEHMAN DAM

Photograph No. 1

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

LAKE LEHMAN DAM

NDI-ID NO. PA-00341
DER-ID NO. 67-480

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

A. Authority

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspections of dams throughout the United States.

B. Purpose

The purpose of this inspection is to determine if the dam constitutes a hazard to human life and property.

1.2 DESCRIPTION OF PROJECT

A. Description of Dam and Appurtenances

Note: Construction drawings indicate a normal pool elevation at elevation 114.0. The U.S.G.S. quadrangle sheet shows a pool elevation of 518.0. Elevation 518.0 is used in this report as normal pool level. All elevations on the construction drawings have to be increased by 404.0 feet for comparison.

Lake Lehman Dam, formerly known as Palingtown Dam, is a zoned earthfill structure with a total length of about 680 feet. The maximum height of the embankment is 52 feet. The spillway is located near the right abutment of the dam and has a 40.5 foot long ogee weir. Two feet high flashboards are installed on top of the weir from May to October to increase the storage capacity of the reservoir. The flashboards have collapsable supports. The intake control structure is located upstream from the crest of the dam near the left end of the embankment and is accessible by a footbridge. Two sliding gates in this tower control the flow through a 30-inch diameter outlet pipe.

B. Location:

North Codorus Township, York County
U.S.G.S. Quadrangle - Seven Valleys, Pa.
Latitude 39°-51.8', Longitude 76°-51.7'
Appendix E, Plates I & II

D. Size Classification: Intermediate: Height - 52 feet
Storage - 635 acre-feet

D. Hazard Classification: High (Refer to Section 3.1.E.)

E. Ownership: P.H. Glatfelter Company
Mr. P.H. Hershey, Technical
Environmental Director
225 South Main Street
Spring Grove, PA 17326

F. Purpose: Water Supply and Recreation

G. Design and Construction History

The dam was designed by Gannett, Eastman & Fleming, Inc., Harrisburg, Pennsylvania. A permit for construction was issued on March 11, 1942. H.J. Williams, York, Pennsylvania, the contractor, started construction on April 1, 1942, and completed the project in November of that year. The design engineers supervised the construction. Several construction progress reports by representatives of the Commonwealth are available in the files. On September 12, 1945, a permit was issued by PennDER for the installation of a collapsable flashboard on the spillway weir from May 1 to October 15 of each year.

H. Normal Operating Procedures

From May 1 to October 15, two feet high flashboards are installed on top of the spillway weir to increase the storage capacity of the reservoir. The upstream gate in the intake structure is always left open. The downstream gate in this structure is regularly operated during the summer to regulate the flow to a downstream reservoir. Water is taken from this reservoir for domestic purposes in the owner's plant and in the town. All inflow above normal pool elevation is discharged through the spillway.

1.3 PERTINENT DATA

A. Drainage Area (square miles)

From files:	3.0
Computed for this report:	2.53
Use:	2.53

B. Discharge at Dam Site (cubic feet per second)
See Appendix D for hydraulic calculations.

Maximum known flood, June, 1972, estimated from records for the U.S.G.S. gaging station located on nearby Codorus Creek	1282

Outlet works at low-pool Elev. 485	64
Outlet works at pool Elev. 518 (normal pool)	150
Spillway capacity at pool Elev. 524.4 (low point of dam)	2544
Spillway capacity with flashboards at pool Elev. 524.4	1150

C. Elevation (feet above mean sea level)

Top of dam (low point)	524.4
Top of dam (design crest)	525
Spillway crest	518
Top of flashboards	520.2
Upstream portal invert	476
Downstream portal invert	474
Streambed at downstream toe of dam (estimate)	473

D. Reservoir (miles)

Length of normal pool (Elev. 518)	.5
Length of maximum pool (Elev. 524.4)	.7

E. Storage (acre-feet)

Spillway crest (Elev. 518)	388
Top of dam (Elev. 524.4)	635

F. Reservoir Surface (acres)

Spillway crest (Elev. 518)	27.5
Top of dam (Elev. 524.4)	32.5

G. Dam

Refer to Plates III & IV in Appendix E for plan and section.

Type: Zoned earthfill.

Length: 680 feet, including a 40.5 foot spillway.

Height: 52 feet.

Top Width: Design - 16 feet; Survey - 18 feet.

Side Slopes:

	Design	Surveyed
Upstream	2.0H to 1V*	2.0H to 1V
Downstream	2.0H to 1V	2.0H to 1V

*Slope is 2.5H to 1V below elevation 505.0.

Zoning: Impervious center core and coarse fill on the outside, including stone facing on both slopes and a downstream toe drain.

Cutoff: Trench excavated on centerline to rock and backfilled with impervious material. A concrete cutoff wall was constructed on the centerline of the trench, three feet in rock and extending 4 feet in the trench.

Grouting: None.

H. Outlet Facilities

Type: 30" CMP with wet well located in upstream slope.

Inlet: 30" CMP, concrete encased, into wet well.

Outlet: 30" CMP, concrete encased, downstream from wet well.

Closure: Slide gates on both upstream and downstream sides of wet well.

Location: Near center of dam.

I. Spillway

Type: Concrete ogee weir with flashboards.

Length of Weir: 40.5'.

Crest Elevation: Ogee: 518.

Top of Flashboards: 520.2.

Location: Right abutment.

Channel: Approach - from lake.
Downstream - concrete rectangular channel with stilling basin.

J. Regulating Outlets

See Section 1.3.H. above.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

The available engineering data for Lake Lehman Dam are limited to a set of design drawings prepared by Gannett Eastman & Fleming, Inc., Harrisburg, Pennsylvania, and a report prepared by the Pennsylvania Department of Environmental Resources (PennDER) upon the application for a construction permit. Two of the three drawings are reproduced in Appendix E of this report as Plates III through VI. The third drawing, not reproduced, shows a large scale (1"=20') general plan of the dam similar to the one shown on Plate III, Appendix E. The drawings indicate all details for the embankment and appurtenant structures as designed by the engineer. The PennDER application report indicates that the spillway was designed for a discharge of 2800 cfs.

2.2 CONSTRUCTION

The available construction data for these facilities include the construction specifications prepared by the engineer and some construction progress reports. Several of these reports were prepared by the design engineer who maintained field inspection during the construction. Other reports were prepared by representatives of PennDER.

Other available construction data include photographs, a geologic report by Mr. Ashley dated May 12, 1942, and a drawing indicating the as-built elevation of the concrete cutoff wall.

The contractor for the project was H.J. Williams Construction Company, York, Pennsylvania. The project started on April 1, 1942, and was completed in November of that year.

The foundations of the cutoff core wall, conduit, intake tower, and spillway were approved by PennDER. The reports and as-built drawings indicate that the bottom of the trench had to be lowered considerably to the left of the outlet pipe due to the presence of broken rock. A trench up to 12 feet deep was excavated in the left hillside. PennDER recommended grouting in this area, but there are no records indicating that this procedure was used.

During the first two months of construction, reports show that the concrete mix used was too wet and placed with poor workmanship. Most of this concrete was placed in the cutoff wall to the right of the outlet pipe. Photographs indicate that shoring and form work was used in a narrow trench to form the core wall. Borrow material for the embankment was obtained from the left and right sides of the reservoir. The topsoil was stripped under the embankment. The placing of the lower part of the embankment was criticized by PennDER. As stated in their report, The material used in the lower part of the embankment had an excess amount

of stone, consisting of "fine soapy shale" and was placed in layers up to 8 to 12 inches thick, without good compaction. By July 21, 1942, workmanship had improved considerably. The section of the core wall between the outlet pipe and the stilling basin was placed in good stiff yellow clay. Another borrow pit with better material was located about 350 yards southwest of the dam site.

The stilling basin was excavated into shale. Several sections of the spillway chute slab were placed on one or two feet deep fills. The intake tower was placed on a gravel material.

2.3 OPERATION

As soon as the reservoir filled with water, it was apparent that considerable leakage was occurring at the left abutment. Weirs were installed to measure the flow. Permission was granted to install flashboards during the month of October in 1943 to evaluate whether or not higher pool levels would increase the leakage. The results indicate that this was the case, and the reported amounts vary from 60,000 gpd to 120,000 gpd. These amounts include the leakage through the outlet pipe gate. Recent readings are shown in Appendix B, page B-4A. The reports in general indicate that the maximum leakage has not increased over the years. Flashboards are in place from April to October each year. The boards are designed to collapse in succession by varying the spacing of the supports (Plate VII, Appendix E). Reports indicate the boards were washed away in 1972 (Agnes) and the owner's representatives stated that the board supports failed three times during the summer of 1980.

2.4 EVALUATION

A. Availability

The available engineering data discussed in this report are located in the files of PennDER at Harrisburg, Pennsylvania. Copies of most of the data and the more recent weir readings are also available in the files of the owner.

B. Adequacy

The available engineering data combined with the visual inspection are considered to be sufficiently adequate to make a reasonable assessment of the dam.

C. Operating Records

The operating records do not include maximum pool levels and are limited to weir readings and in-house inspection and maintenance records.

D. Post Construction Changes

Post construction changes were limited to the extension of the wingwalls on the outlet structure and the installation of the flashboards.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of Lake Lehman Dam is good. The slopes are protected with dumped rock and clear of brush and weeds except at the downstream toe. The toe is overgrown with heavy brush and brambles. Water was detected running in the rock toe at the left side; however, brush prevented close observation of this condition. A wet flat area is located immediately to the left of the outlet pipe. Water is flowing into the outlet channel from this seepage.

The intake tower and gate operator stands are in good condition. The spillway consists of a concrete ogee section with 26.5-inch high collapsable flashboards. The U-shaped spillway outlet channel is 600 feet long and consists of a concrete slab poured between concrete walls. All concrete work is in good condition. Some spalling has occurred and most of the slab joints are open. Some of the walls have tilted slightly.

The visual inspection check list and sketches of the general plan and profile of the dam, as surveyed during the inspection, are presented in Appendix A of this report.

Photographs taken on the day of inspection are reproduced in Appendix C. Messrs. Metzger, Bortner and Roth represented the owners during the inspection.

B. Embankment

The upstream slope is covered with dumped rock and is mostly free of weeds. The top of the dam has a 3/4-inch stone surface and is in excellent condition. The horizontal alignment is straight. The spillway crest is angled to the centerline of the dam and the small embankment on the right abutment is in line with the spillway crest. The vertical profile is up to half a foot below the design crest elevation (Plate II, Appendix A). The downstream slope has a good dumped rock protection over its full height (Photographs No. 2 and No. 3). There were no signs of unusual displacements. However, the slope is slightly concave at some locations with the steeper part near the toe. The slope was apparently constructed this way. Heavy brush and brambles are present at the downstream toe over the full length of the dam. A rock toe drain is located in this area. During the inspection water was heard running starting near the left abutment and extending to a location near the outlet ditch where the area is flat and wet. Seepage water was noticed coming through the walls of the outlet structure. The heavy brush prevented close observation of the toe. A weir is located in the

outlet channel and measures of the flow are taken on a weekly basis. At the time of inspection, the flow was measured at 3.5 inches over the weir, or about 51 gallons per minute (73,400 gpd).

C. Appurtenant Structures

The spillway, located near the right abutment, consists of a 40.5 foot wide ogee weir section. Flashboards, about two feet high, were in place on top of the weir at the time of the inspection. The owner's representatives stated that the board supports failed three times during the summer of 1980. A 2-inch diameter pipe, which is installed from the reservoir over the flashboards and into the outlet channel, acts as a siphon to provide a minimum flow of water to a small fish pond located about 800 feet west of Lake Lehman Dam.

The spillway discharge channel is a 600 foot long U-shaped channel with a stilling basin at the end. The concrete of the spillway and discharge channel are in general good condition. The slab joints are open and have lost most of their expansion joint material. Several wall sections in the stilling basin are tilted. The maximum observed deflection at the top of the wall was 2.5 inches. Reports of the owner indicate that the amount of deflection has been consistent over the last five years. The maximum height of the wall sections is about 15 feet. A 10-inch drain pipe is located in the stilling basin and appears to be a longitudinal collector under the spillway slab.

The intake structure is located on the upstream side of the dam crest and is accessible from the crest by a small footbridge. The tower platform has two gate controls. The upstream gate controls the flow from the reservoir into the control tower. This gate is always open and the tower functions as a wet well. The downstream gate is used regularly to control the discharge through the outlet pipe. The water supply intake is located at a downstream reservoir which is replenished as required by opening the gate at Lake Lehman Dam. The gate was operated at the time of inspection and is in excellent operating condition. The outlet of the 30-inch outlet pipe has a concrete headwall and wingwalls. The wingwalls were extended with stone masonry walls (Photograph No. 5).

D. Reservoir Area

The reservoir is surrounded with woodlands with moderate slopes which appear to be stable. Most of the drainage area consists of cultivated land. Moderate siltation is reported in the upstream area of the reservoir.

E. Downstream Channel

The immediate downstream area of the spillway is moderately sloping with mostly meadowlands and some wooded areas. The creek passes under Route 116 about 1700 feet downstream from the dam. A gasoline

station is located near this crossing. At the downstream side of the bridge there is a reservoir used for the water supply intake and a filter plant.

There is a potential hazard for loss of life on the highway and at the filter plant if the dam would fail. The hazard category of Lake Lehman Dam is considered to be "High."

3.2 EVALUATION

The overall visual inspection of the facilities at Lake Lehman indicate that the dam is in good condition. The brush at the toe should be removed to permit better and regular inspection of the toe. The seepage condition has been in existence for many years and the amount appears to be stable. The deflection of the spillway walls requires continued close observation. These walls are located downstream from the dam. A collapse would obstruct the discharge but not endanger the safety of the dam. The joints between spillway slabs should be filled to prevent ice damage or uplift.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The operational procedures for Lake Lehman Dam include a yearly in-house inspection of the facilities with an in-house report indicating necessary repairs and maintenance items. Weekly weir readings are made and reported.

The flashboards are installed around May 1 and removed around October 15 on an annual basis. Cables are attached to the flashboard permitting removal of these boards in an emergency. The gate on the intake structure is operated regularly.

4.2 MAINTENANCE OF DAM

The embankment is protected with riprap and no maintenance is required. The downstream toe has been overgrown with brush and should be cleared of brush and trees.

4.3 MAINTENANCE OF OPERATING FACILITIES

The operating stands on the intake tower are greased on an annual basis and the downstream gate was easily operated on the day of inspection.

The flashboards on the spillway weir are installed and removed as required by the permit.

4.4 WARNING SYSTEM

The owners have a plan on file with PennDER indicating that all company owned dams are placed under surveillance when water rises to a level of 35 inches over the crest of Mill Dam, one of their dams.

4.5 EVALUATION

The operational procedures for Lake Lehman are good. The only recommendation is the removal of brush and the annual maintenance of the downstream toe area.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic analyses available from PennDER for Lake Lehman Dam were not very extensive. No stage-discharge curve, unit hydrograph, or flood routings were contained in the PennDER files. A partial list of stage-storage data was contained in the files (Plate IV, Appendix E).

B. Experience Data

There are no official records of flood levels at Lake Lehman Dam. Based on records of the U.S.G.S. stream gage on Codorus Creek at nearby Spring Grove, Pennsylvania, the maximum inflow to Lake Lehman is estimated to be 1282 cfs. An inspection report after the June, 1972, flood states that the estimated flow over the weir was four feet. This would produce a discharge of 1257 cfs. This flood event was passed without problems.

C. Visual Observations

On the date of the inspection, no conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily during a flood event until the dam is overtopped. Flashboards were in place on the spillway crest. It was reported that these fail normally during periods of high flow. A 2-inch siphon pipe was in place carrying water over the spillway crest. This pipe would washout when the flashboards fail.

D. Overtopping Potential

Lake Lehman Dam has a total storage capacity of 635 acre-feet and an overall height of 52 feet, both referenced to the top of the dam. These dimensions indicate a size classification of "Intermediate"; the hazard classification is "High" (see Section 3.1.E.).

The recommended Spillway Design Flood (SDF) for a dam having the above classification is the Probable Maximum Flood (PMF). For this dam, the SDF peak inflow is 6789 cfs (see Appendix D for HEC-1 inflow computations).

Comparison of the estimated SDF peak inflow of 6789 cfs with the estimated spillway discharge capacity of 2544 cfs (without flashboards in place) indicates that a potential for overtopping of Lake Lehman Dam exists.

An estimate of the storage effect of the reservoir and routing of the computed inflow hydrograph through the reservoir shows that this dam does not have the necessary storage available to pass the SDF without overtopping. The spillway-reservoir system can pass a flood event equal to 21% of a PMF with the flashboards in place, and 43% of a PMF with the flashboards removed. These calculations are based on the present low point in the dam profile.

Although 50% of the PMF causes 0.5 foot of overtopping, with the flashboards removed, it is expected that the riprap protection on the embankment slopes would prevent failure of the embankment.

E. Spillway Adequacy

The intermediate size category and high hazard category, in accordance with the Corps of Engineers criteria and guidelines, indicates that the SDF for this dam should be the full PMF.

Calculations show that the present spillway discharge capacity and reservoir storage capacity combine to handle 43% of the PMF with the flashboards removed. Since the combined spillway discharge and reservoir storage capacity cannot pass the SDF with the flashboards removed, and since 50% of the PMF is not expected to cause failure, the spillway is judged to be inadequate, but not seriously inadequate.

If the top of the dam would be made uniform at the design elevation over its entire length and the flashboards were not in place, the project could pass 49% of the PMF without overtopping. Under this condition, 50% of the PMF would cause 0.1 foot overtopping of the embankment. This amount of overtopping is not expected to cause failure. Therefore, the spillway is considered to be inadequate but not seriously inadequate.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observations

1. Embankment

The visual inspection of Lake Lehman Dam did not detect any signs of embankment instability. The field survey indicates that the embankment slopes are equal to the proposed slopes on the design drawings. The slopes are considered to be adequate for the height of the dam under consideration. The profile of the dam indicates that the crest is fairly level and slightly below its design crest elevation. The downstream slope is protected with heavy riprap and would be stable under a limited amount of overtopping.

The seepage in the left abutment is considerable; however, it appears to have been a constant amount over the years, with slight variation due to pool level (refer to page B-4A, Appendix B).

2. Appurtenant Structures

The spillway and chute appear to be in good condition with the exception of the slight tilting of some of the wall sections. Reports indicate that the amount of deflection has been stable over the recent years. The control tower, the gate operator stand and the outlet structure are in good condition without signs of instability.

B. Design and Construction Data

1. Embankment

The design data indicates a well designed embankment with a cutoff trench and cutoff wall keyed into an impervious material. The construction had some poor workmanship. This could be the origin of some of the leakage. The quality of the rock in the left hillside indicates that leakage could occur around the end of the cutoff wall and through the foundation.

2. Appurtenant Structures

The design drawings indicate that the spillway weir was keyed into rock and that cutoff walls were to be constructed into the embankment. All spillway and stilling basin walls are gravity type walls. Backfill was placed behind the walls over most of the chute length (Plate III, Appendix E). The footing width of the walls is 0.4 times the height of the walls. This ratio is adequate for rock foundation and for drained backfill. Construction data indicates, however,

that not all walls were founded on rock and design drawings do not indicate drainage filters behind the walls. These conditions probably caused some of the tilting of the walls. These deflections are not considered to be serious at the present time. The outlet pipe is encased in concrete and has been constructed with anti-seepage collars.

C. Operating Records

Records indicate that leakage has occurred since the initial filling of the reservoir. The maximum flow over the spillway occurred during Agnes (1972) and a report indicates that no damage occurred.

D. Post Construction Changes

To prevent washouts at the outlet structure, the wingwalls were extended and riprap was placed in the channel. The design drawings indicate only one gate in the intake structure. A second gate was, however, constructed at the downstream outlet side of the control tower.

Flashboards with supports at varying spacing were installed in 1945 to increase the storage capacity during the summer months and early fall.

E. Seismic Stability

This dam is located in Seismic Zone 1, and it is considered that the static stability is sufficient to withstand minor earthquake induced dynamic forces. No studies or calculations have been made to confirm this assumption.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection of the dam and the review of the construction drawings indicate that Lake Lehman Dam is in good condition and was designed in accordance with acceptable engineering practices. The field inspection did not detect any signs of instability. The leakage at the left downstream toe is of some concern, but appears to have been constant over the past 35 years.

The hydrologic and hydraulic computations indicate that the combination of storage capacity and the spillway discharge capacity is insufficient to pass the SDF without overtopping the dam. The spillway is considered to be inadequate, but not seriously inadequate. If the top of dam would be made uniform at the design elevation, the spillway would pass about 49 percent of the PMF.

B. Adequacy of Information

The design information contained in the files combined with the visual inspection are considered sufficiently adequate for making a reasonable assessment of this dam.

C. Urgency

The recommendations presented below should be implemented immediately.

D. Additional Studies

Additional investigations are required to determine measures necessary to provide an adequate spillway capacity unless the crest of the dam is restored to its original design crest elevation.

7.2 RECOMMENDATIONS

In order to assure the continued satisfactory operation of this dam, the following recommendations are presented for immediate implementation by the owner:

1. That measures shall be taken to provide an adequate spillway capacity, which shall include the raising of the embankment profile uniformly to at least its design crest elevation.

2. That the downstream toe and an area 20 feet beyond the toe be cleared on a regular basis of all brush, weeds and trees, permitting close observation of the seepage.

3. That the slab joints in the spillway channel be filled with a joint material.

4. That the seepage be monitored on a regular basis. If turbidity or an increase in flow is detected, immediate action shall be taken to correct this condition.

5. That close observation be maintained of the tilted walls in the spillway. If additional movement is recorded, measures shall be taken to correct this condition.

6. That an operation and maintenance manual be prepared for guidance in the operation of the dam during normal and emergency conditions, and that a schedule be developed for the annual inspection of the dam and its appurtenant structures.

APPENDIX A

CHECK LIST OF VISUAL INSPECTION REPORT

CHECK LIST

PHASE I - VISUAL INSPECTION REPORT

PA DER # 67-480 NDI NO. PA-00 341

NAME OF DAM Lake Lehman Dam HAZARD CATEGORY High

TYPE OF DAM Earthfill

LOCATION North Codorus TOWNSHIP York COUNTY, PENNSYLVANIA

INSPECTION DATE 10/9/80 WEATHER Sunny, clear TEMPERATURE 60's

INSPECTORS: R. Houseal (Recorder) OWNER'S REPRESENTATIVE(s):

H. Jongsma Larry R. Metzger

R. Shireman Robert B. Bortner

A. Bartlett Joe Roth

NORMAL POOL ELEVATION: 518 (U.S.G.S.) AT TIME OF INSPECTION: 520.2

BREAST ELEVATION: 525 (Design) POOL ELEVATION: 519.9

SPILLWAY ELEVATION: 518.0 TAILWATER ELEVATION:

MAXIMUM RECORDED POOL ELEVATION: No records

GENERAL COMMENTS:

The general appearance of the dam is good. There are no obvious signs of distress. The slopes, both upstream and downstream, are uniform. A 2" galvanized pipe serves as a siphon over the spillway for water supply to a fish pond. Water used as domestic water in the plant and in Spring Grove. There is an annual in-house inspection. A flood control plan is on file with PennDER.

NDI NO. PA-00341

VISUAL INSPECTION
EMBANKMENT

	OBSERVATIONS AND REMARKS
A. SURFACE CRACKS	None observed.
B. UNUSUAL MOVEMENT BEYOND TOE	None observed.
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	None observed. Downstream slope slightly concave.
D. ALIGNMENT OF CREST: HORIZONTAL: VERTICAL:	Horizontal - good. Vertical - Refer to profile Plate A-II.
E. RIPRAP FAILURES	None observed.
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	All junctions with the embankment appear sound.
G. SEEPAGE	Seepage along the left toe of embankment beginning below the elevation of the water surface. Swampy to outlet.
H. DRAINS	None observed.
J. GAGES & RECORDER	Weir located in the outlet channel. V-notch with 3-1/2" flow.
K. COVER (GROWTH)	Top - 3/4" stone surface. Upstream and downstream slopes are covered with dumped rock 6"-18" size. Heavy brush at toe.

NDI NO. PA-00 341

VISUAL INSPECTION
OUTLET WORKS

	OBSERVATIONS AND REMARKS
A. INTAKE STRUCTURE	Concrete tower supporting exposed gate lifts. Gate crank chained to the lift. Good condition.
B. OUTLET STRUCTURE	Concrete walls. Walls extended with cemented stone walls.
C. OUTLET CHANNEL	Natural stream.
D. GATES	Two on tower. Downstream gate operated easily. Upstream gate normally open.
E. EMERGENCY GATE	Same as above.
F. OPERATION & CONTROL	Downstream gate operated often in summertime. Greased annually.
G. BRIDGE (ACCESS)	Concrete deck directly from the top of the embankment to tower.

NDI NO. PA-00 341

VISUAL INSPECTION
SPILLWAY

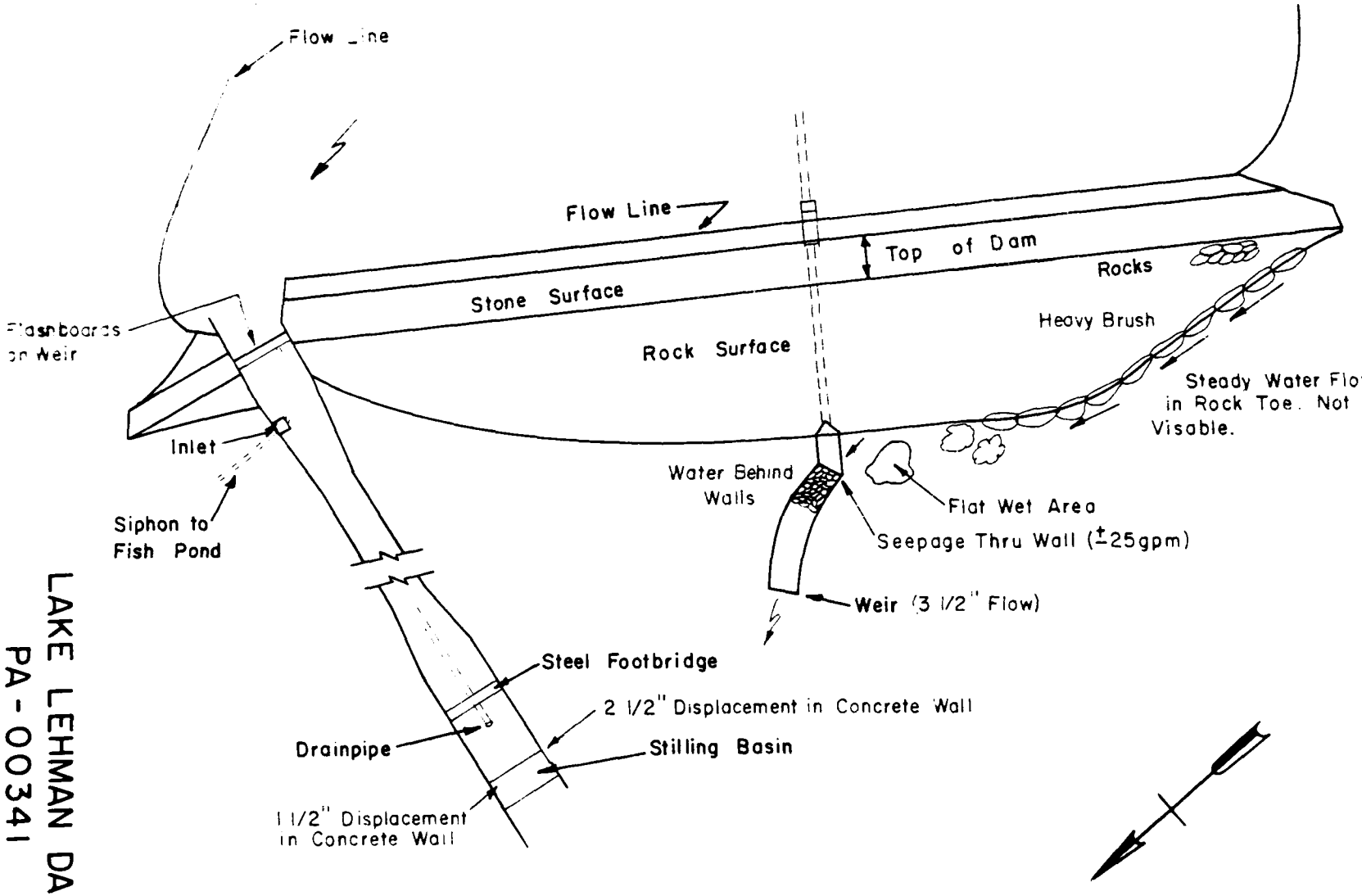
	OBSERVATIONS AND REMARKS
A. APPROACH CHANNEL	Spillway located about 60 feet from right end of the embankment. Approach is directly from reservoir.
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	Concrete ogee section with 10 flashboards (26-1/2" high) supported with fail rods. (Boards failed at least three times during summer 1980.) Concrete is in good condition. 2" pipe siphon across spillway for water supply to fish pond.
C. DISCHARGE CHANNEL: Lining Cracks Stilling Basin	Spillway walls shows fine map cracking on surface - some leaching of lime. Slabs in spillway outlet channel appear good. No serious cracks or breaks. Spillway slab joints material worn out. Joints should be sealed. Some wall sections have tilted slightly.
D. BRIDGE & PIERS	None over spillway crest. Footbridge several hundred feet downstream from the spillway across the spillway outlet channel.
E. GATES & OPERATION EQUIPMENT	Flashboards control - in place between May and October.
F. CONTROL & HISTORY	Water used primarily for domestic use in Spring Grove. Can be used for industrial purposes. Owner treats water for public use.

NDI NO. PA-00 341

VISUAL INSPECTION

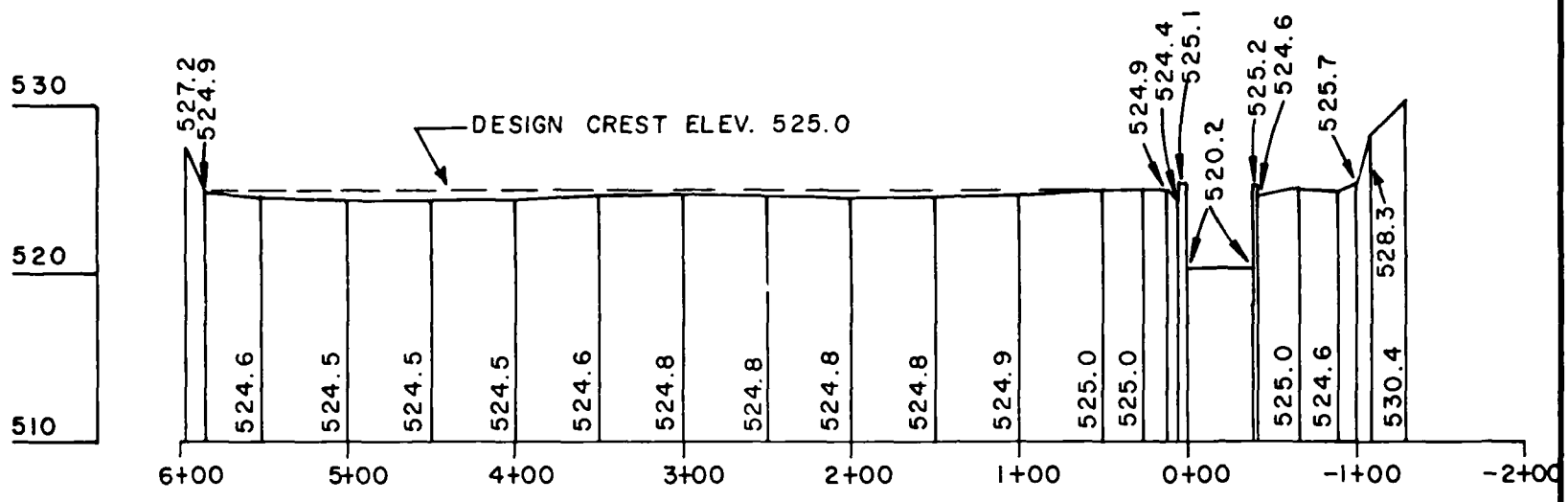
	OBSERVATIONS AND REMARKS
INSTRUMENTATION Monumentation	None.
Observation Wells	None.
Weirs	One weir in use located in the downstream channel of the outlet pipe.
Piezometers	None.
Staff Gauge	None.
Other	None.
RESERVOIR Slopes	Wooded.
Sedimentation	Moderate siltation at upstream end.
Watershed Description	Some woodlands, mostly agriculture.
DOWNSTREAM CHANNEL Condition	Meadowlands with some wooded areas.
Slopes	Moderately sloping.
Approximate Population	Varies, travellers on highway.
No. Homes	Route 116 and gasoline station immediately downstream. Dam and filter plant on downstream side of highway.

SURVEYED 10-9-80

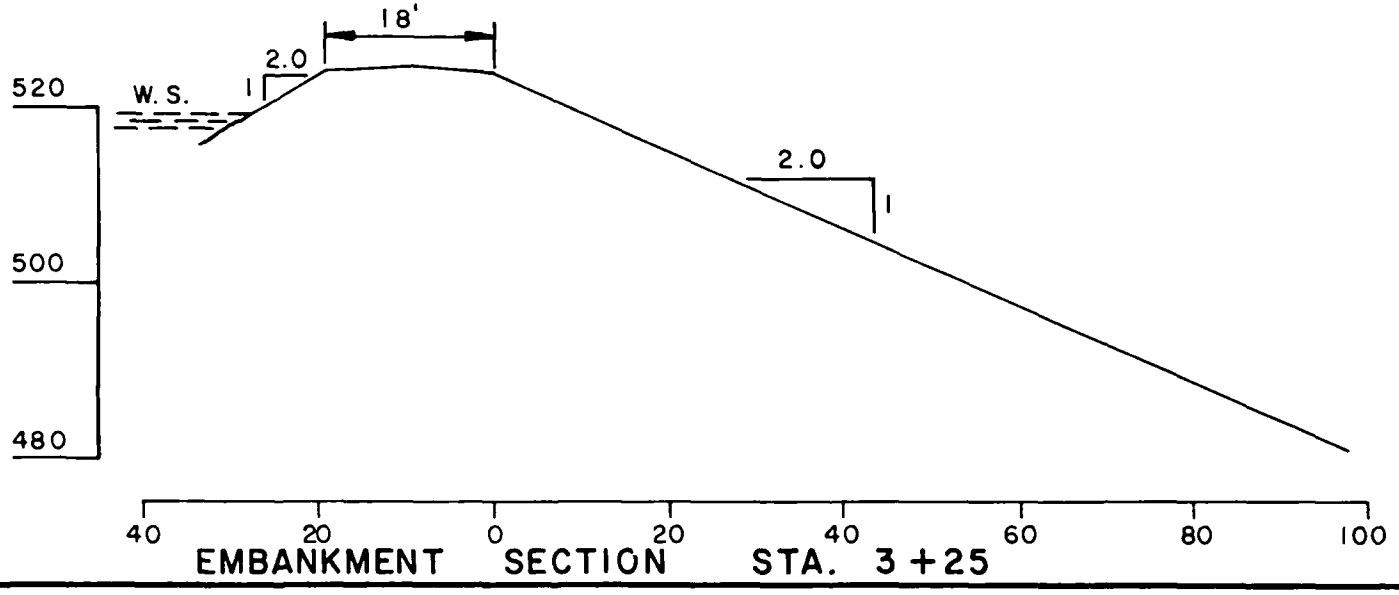


LAKE LEHMAN DAM
PA-00341
INSPECTION SURVEY
PLATE A-I

SURVEYED 10-9-80



EMBANKMENT PROFILE



EMBANKMENT SECTION STA. 3+25

LAKE LEHMAN DAM
PA-00341
INSPECTION SURVEY
PLATE A-II

APPENDIX B

CHECK LIST OF ENGINEERING DATA

CHECK LIST
ENGINEERING DATA

PA DER # 67-480 NDI NO. PA-00341

NAME OF DAM LAKE LEHMAN DAM

ITEM	REMARKS
AS-BUILT DRAWINGS	Design drawings. One marked-up drawing indicating depth of cutoff wall as built.
REGIONAL VICINITY MAP	U.S.G.S. Quadrangle - Seven Valleys, Pa. See Plate II, Appendix E
CONSTRUCTION HISTORY	Permit issued March 11, 1942. Constractor, H.J. Williams Construction Co., York, Pennsylvania, started April 1, 1942. Completed November, 1942. Initial construction period had poor concrete quality.
GENERAL PLAN OF DAM	Plate III, Appendix E.
TYPICAL SECTIONS OF DAM	Plate IV, Appendix E.
OUTLETS: PLAN DETAILS CONSTRAINTS DISCHARGE RATINGS	 Plates III & IV, Appendix E. 30-inch pipe closed off in manhole with sliding gate. None.

NDI NO. PA-00341

ENGINEERING DATA

ITEM	REMARKS
RAINFALL & RESERVOIR RECORDS	Some records in PennDER files for periods between 1943 and 1951. These were recorded in connection with leakage.
DESIGN REPORTS	No.
GEOLOGY REPORTS	A letter by George H. Ashley written after construction was started in PennDER files.
DESIGN COMPUTATIONS: HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS: BORING RECORDS LABORATORY FIELD	None.
POST CONSTRUCTION SURVEYS OF DAM	None, except weir measurements.
BORROW SOURCES	Construction progress reports indicate borrow areas to be loacted in the reservoir area on both hillside and at a place 1050 feet southwest of dam.

ENGINEERING DATA

ITEM	REMARKS
MONITORING SYSTEMS	Weirs placed in 1943 to monitor leakage.
MODIFICATIONS	Outlet pipe extended with a U-shaped channel.
HIGH POOL RECORDS	None. Estimated in a report at four feet over weir in June, 1972.
POST CONSTRUCTION ENGINEERING STUDIES & REPORTS	None. The owner makes an annual maintenance report in-house. Weir readings are available.
PRIOR ACCIDENTS OR FAILURE OF DAM Description: Reports:	None.
MAINTENANCE & OPERATION RECORDS	Some maintenance report.
SPILLWAY PLAN, SECTIONS AND DETAILS	See Plates III, V & VI, Appendix E.

ENGINEERING DATA

ITEM	REMARKS
OPERATING EQUIPMENT, PLANS & DETAILS	Upstream gate detailed on design drawings. Details of flashboards on Plate VII, Appendix E.
CONSTRUCTION RECORDS	One drawing indicating as-built elevation of concrete core wall. Several construction progress reports prepared by PennDER and the engineer. Several construction photographs.
PREVIOUS INSPECTION REPORTS & DEFICIENCIES	Some inspection reports by PennDER. Seepage has been reported since construction was completed. The bituminous joint sealer in the spillway slab appears to be washed out many times.
MISCELLANEOUS	

LAKE LEHMAN LEAKAGE DATA AND FLOOD CONTROL INSPECTION

Leakage Measurements

Leakage readings are obtained below all reservoirs by Joe Roth on a routine basis. Listed below is a summary of the last two years of monthly readings compared to that obtained in the middle of years 1970-78.

Year	Date	Inches[a] Over Weir	GPM[a]	Lake Level[b] Inches Over Spillway
1970	7-15	4 1/4	85	+24
1971	7-15	4	74	+24
1972	7-14	3 1/2	52	+8
1973	7-15	3 3/4	63	+24
1974	9-20	3 1/2	52	+24
1975	7-18	2	12	+24
1976	8-18	3	34	+24
1977	8-19	Weir out	--	+24
1978	9-13	3 1/4	42	+24
1979	1-16	3 1/4	42	+24
	2-28	4	74	+24
	3-14	3 3/4	63	+24
	4-18	3 3/4	63	+24
	5-17	3 7/8	68	+24
	6-14	4	74	+24
	7-19	4	74	+24
	8-15	4	74	+24
	9-15	4	74	-3
	10-15	Draining	--	-12
	11-14	Draining	--	-14
	12-14	4 3/8	91	+21
1980	1-17	4 1/8	79	+24
	2-15	4 1/8	79	+24
	3-19	4 3/4	110	+24
	4-17	4 3/4	110	+24
	5-15	4	74	+4
	6-12	Draining	--	+2
	7-17	4 1/2	97	+24
	8-19	4	74	+24
	9-23	3 3/4	63	+24

(a) Leakage determined at V-notch weir located in normal drainage ditch below the center of the dam breast.

(b) Flashboards are installed 5/15 - 10/15 raising level 2 feet above spillway.

NDI NO. PA-00 341

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Farmland

ELEVATION:

TOP NORMAL POOL & STORAGE CAPACITY: Elev. 518 Acre-Feet 388

TOP FLOOD CONTROL POOL & STORAGE CAPACITY: Elev. 524.4 Acre-Feet 635

MAXIMUM DESIGN POOL: Elev. 525

TOP DAM: Elev. 524.4 as surveyed, 525.0 as designed.

SPILLWAY:

a. Elevation 518

b. Type Concrete ogee with wooden flashboards.

c. Width 40.5'

d. Length 600 feet.

e. Location Spillover Right abutment.

f. Number and Type of Gates None.

OUTLET WORKS:

a. Type 30" diameter CMP with slide gates in wet well.

b. Location Upstream slope near center of dam.

c. Entrance inverts 476

d. Exit inverts 474

e. Emergency drawdown facilities Slide gate.

HYDROMETEOROLOGICAL GAGES:

a. Type None.

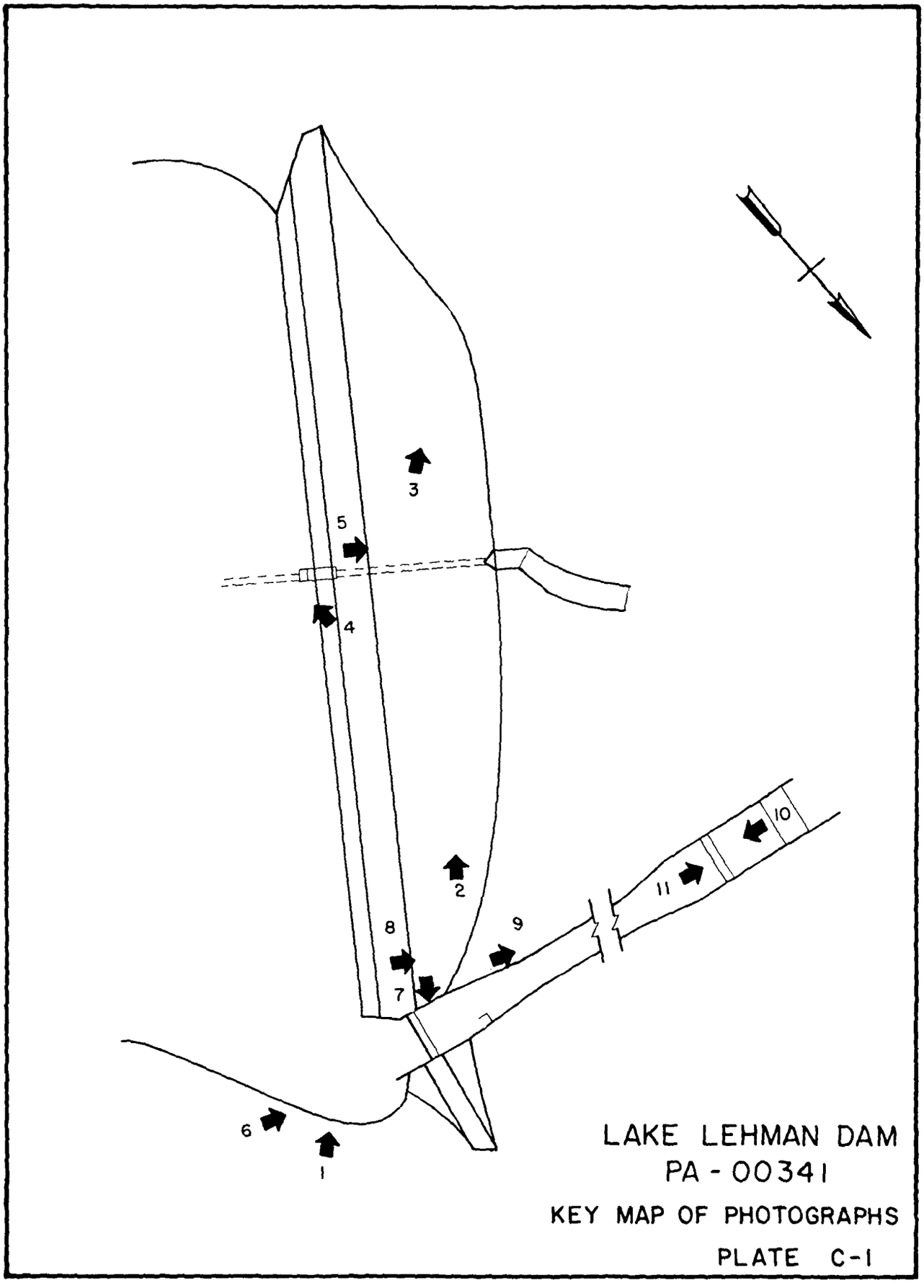
b. Location

c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 2544 cfs.

APPENDIX C

PHOTOGRAPHS

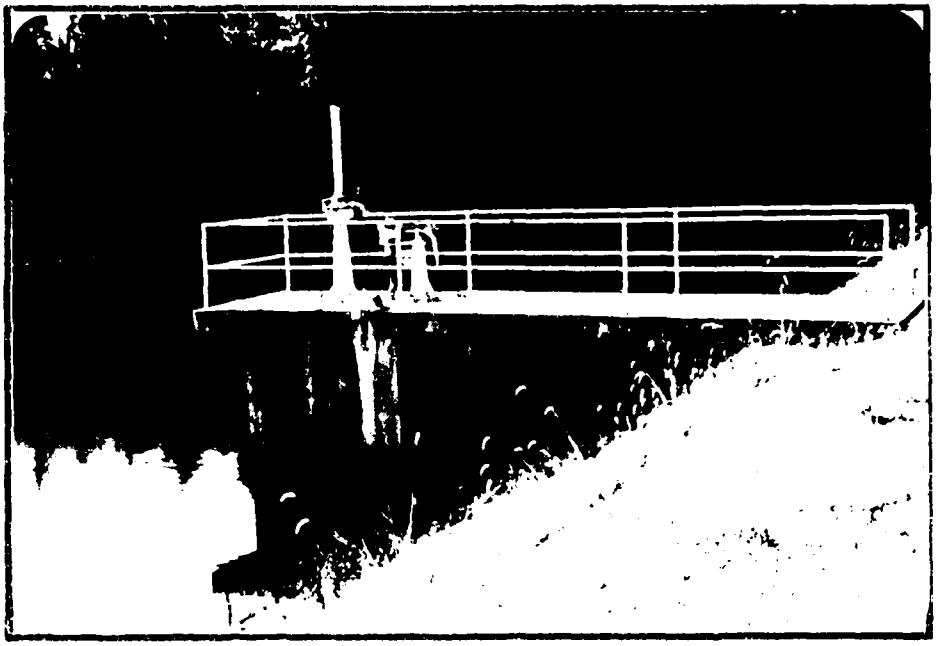


LAKE LEHMAN DAM
PA - 00341
KEY MAP OF PHOTOGRAPHS
PLATE C-1

GENERAL VIEW OF DOWNSTREAM SLOPE - NO. 2

VIEW OF BRUSH AT DOWNSTREAM TOE - NO. 3

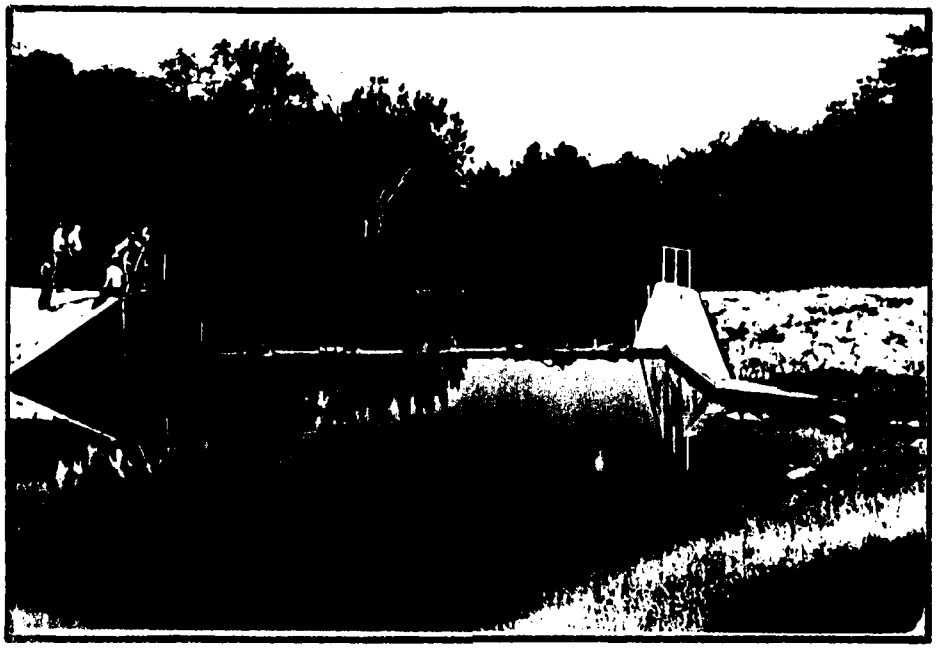
PA-00361
Plate C-11



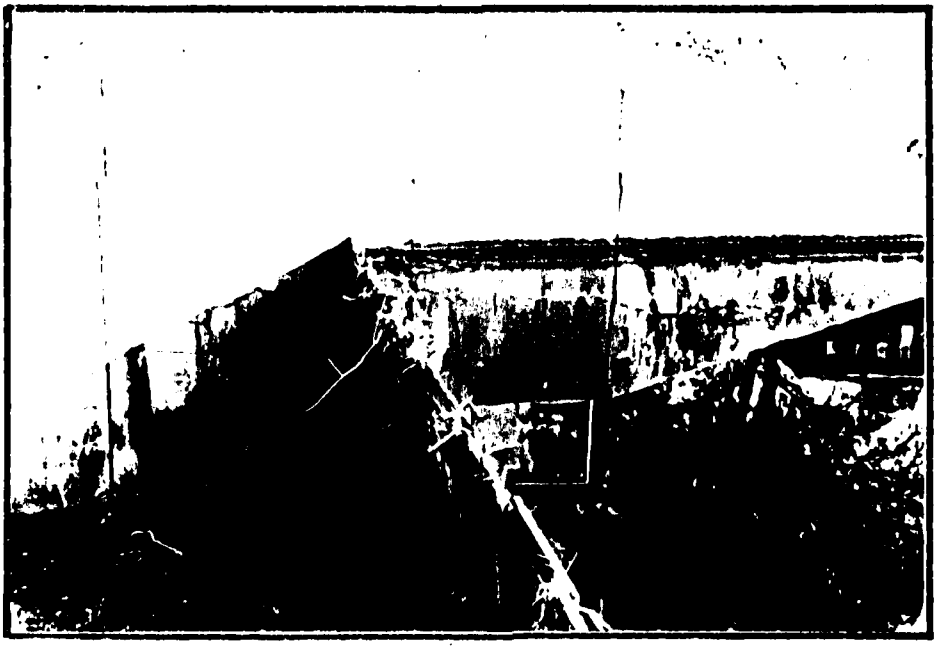
UPSTREAM CONTROL TOWER WITH FOOTBRIDGE - NO. 4

OUTLET CHANNEL - NO. 5
SHOWING FLARED WINGWALLS

PA-00351
PLATE C-111

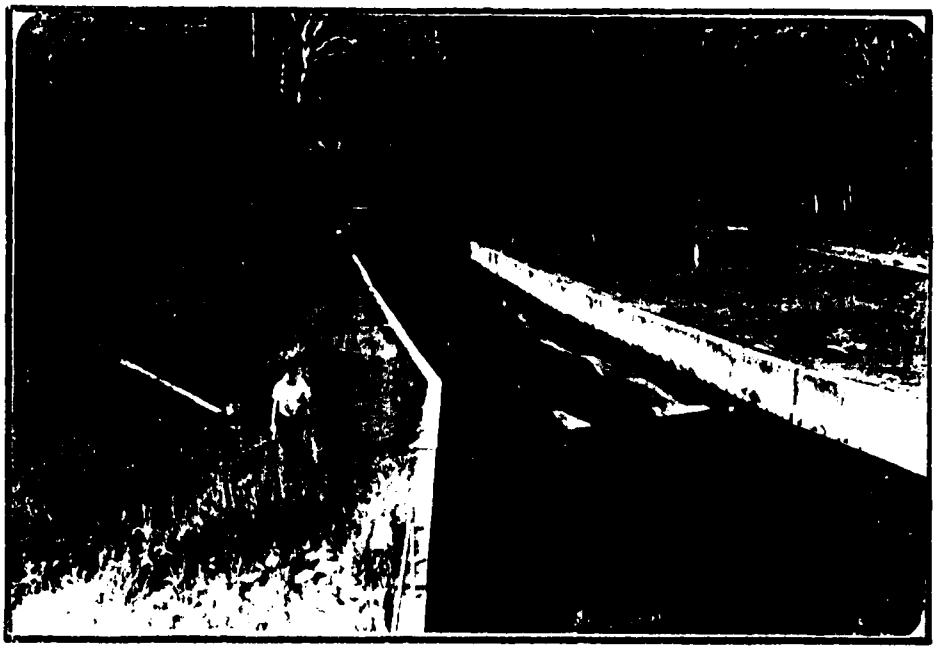


FOREBAY & SPILLWAY ABUTMENT WALLS - NO. 6



FLASHBOARDS ON SPILLWAY - NO. 7

PA-00341
Plate C-IV



SPILLWAY CHANNEL WITH FOOTBRIDGE - NO. 8

TILTED WALL OF SPILLWAY CHANNEL - NO. 9

PA-00341
Plate C-V

STILLING BASIN LOOKING UPSTREAM - NO. 10

DOWNSTREAM CHANNEL - NO. 11
NOTE: TILTED WALL

PA-00341
Plate C-VI

APPENDIX D

HYDROLOGY AND HYDRAULIC CALCULATIONS

SUMMARY DESCRIPTION
OF
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION

The hydrologic and hydraulic evaluation for this inspection report has employed computer techniques using the Corps of Engineers computer program identified as the Flood Hydrograph Package (HEC-1) Dam Safety Version.

The program has been designed to enable the user to perform two basic types of hydrologic analyses: (1) the evaluation of the overtopping potential of the dam, and (2) the capability to estimate the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. A brief summary of the computation procedures typically used in the dam overtopping analysis is shown below.

- Development of an inflow hydrograph to the reservoir.
- Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.
- Routing of the outflow hydrograph(s) of the reservoir to desired downstream locations. The results provide the peak discharge and maximum stage of each routed hydrograph at the outlet of the reach.

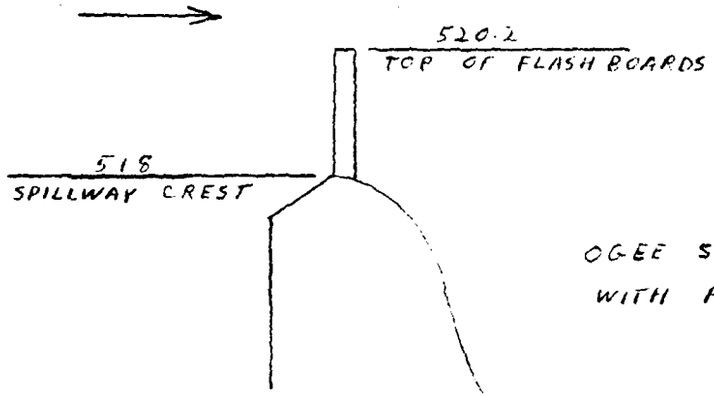
The output data provided by this program permits the comparison of downstream conditions just prior to a breach failure with that after a breach failure and the determination as to whether or not there is a significant increase in the hazard to loss of life as a result of such a failure.

The results of the studies conducted for this report are presented in Section 5.

For detailed information regarding this program refer to the Users Manual for the Flood Hydrograph Package (HEC-1) Dam Safety Version prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California.

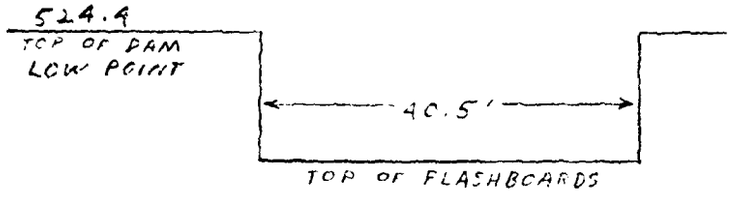
BY RLS DATE 10/2/86 **BERGER ASSOCIATES** SHEET NO. 1 OF 2
CHKD. BY DATE PROJECT DOS93
SUBJECT LAKE LEHMAN DAM

SPILLWAY RATING



OGEE SECTION
WITH FLASHBOARDS

C (FLASHBOARDS) = 3.3 (KINGS HDBK.)
C (OGEE) = 3.88 (SMALL DAMS, PG 249)



$Q = C L H^{3/2}$

WITH FLASHBOARDS, $H = 524.4 - 520.2 = 4.2'$
WITHOUT FLASHBOARDS, $H = 524.4 - 518 = 6.4'$

WITH FLASHBOARDS

$Q = 3.3 \times 40.5 \times (4.2)^{1.5}$

$= 1150$ cfs

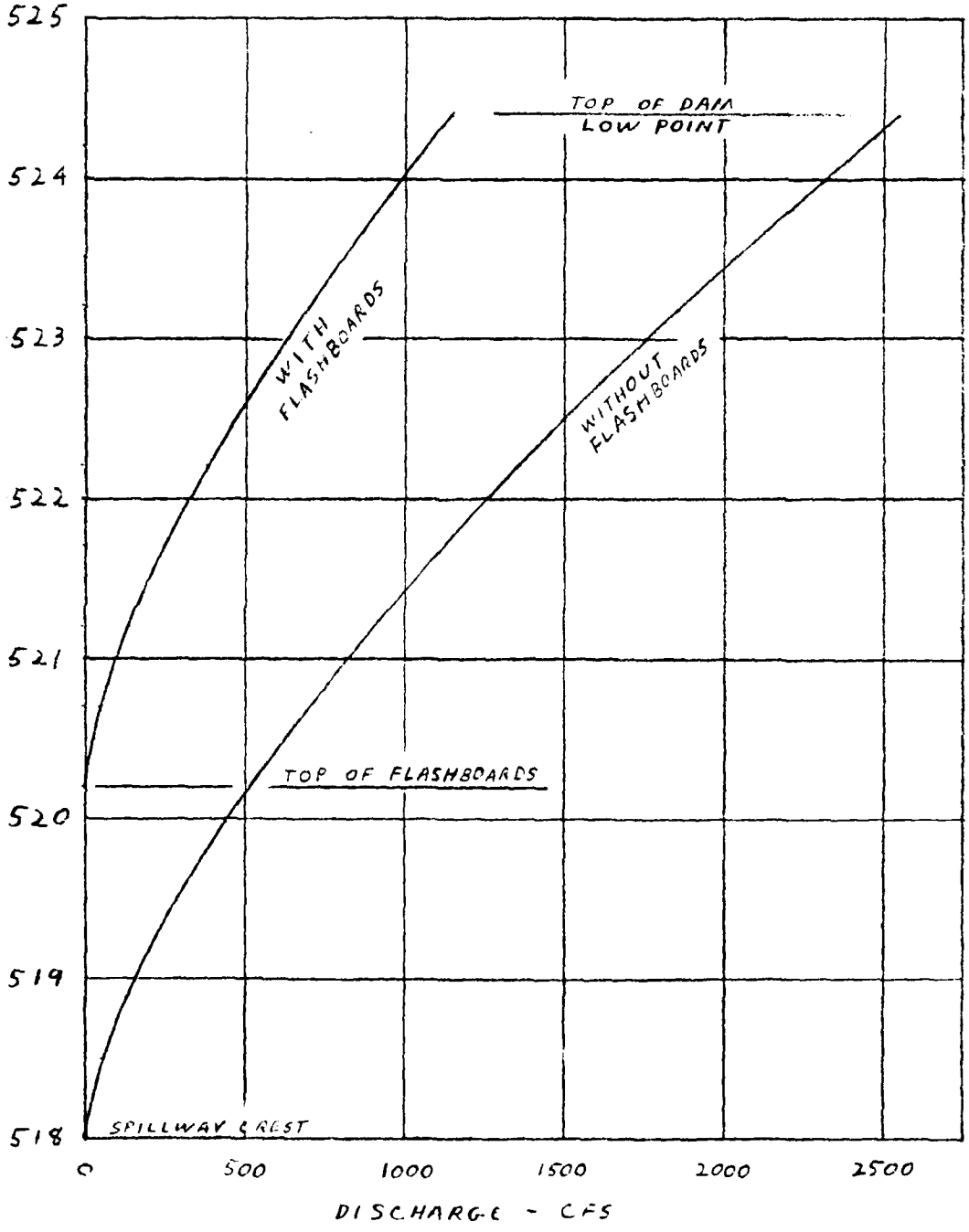
WITHOUT FLASHBOARDS

$Q = 3.88 \times 40.5 \times (6.4)^{1.5}$

$= 2544$ cfs

BY RLS DATE 10/27/80 **BERGER ASSOCIATES** SHEET NO. 2 OF 9
CHKD. BY DATE PROJECT 00590
SUBJECT LAKE LEHMAN DAM

SPILLWAY RATING CURVE



BY RLS DATE 10/29/80 **BERGER ASSOCIATES** SHEET NO. 3 OF 8
CHKD. BY DATE PROJECT D0590
SUBJECT LAKE LEHMAN DAM

DISCHARGE THROUGH OUTLET WORKS

30" DIA. CMP WITH SLIDE GATES IN WET WELL

INVERT ELEV. = 476

$Q = C A \sqrt{2gH}$ $C = 0.6$ (KING'S HDBK.)

AT POOL LEVEL = 518

$H = 518 - 477.5 = 40.5'$

$Q = 0.6 \times \pi \times \frac{(2.5)^2}{4} \times (2 \times 32.2 \times 40.5)^{0.5}$

$= 150.4$ SAY 150 CFS

AT LOW POOL LEVEL = 485

$H = 485 - 477.5 = 7.5'$

$Q = 0.6 \times \pi \times \frac{(2.5)^2}{4} \times (2 \times 32.2 \times 7.5)^{0.5}$

$= 64.7$ SAY 64 CFS

BY RLS DATE 10/29/80 BERGER ASSOCIATES SHEET NO. 4 OF 8
CHKD. BY ____ DATE ____ PROJECT D0590
SUBJECT LAKE LEHMAN DAM

EMBANKMENT RATING

$Q = C L H^{3/2}$ $C = 2.7$ (APPROX MEAN)

AT ELEV 525

$2.7 \times 24 \times (.2)^{1.5}$	=	6
$2.7 \times 25 \times (.2)^{1.5}$	=	6
$2.7 \times 9 \times (.2)^{1.5}$	=	1
$2.7 \times 9 \times (.35)^{1.5}$	=	5
$2.7 \times 15 \times (.05)^{1.5}$	=	-
$2.7 \times 50 \times (.05)^{1.5}$	=	2
$2.7 \times 50 \times (.1)^{1.5}$	=	9
$2.7 \times 150 \times (.2)^{1.5}$	=	36
$2.7 \times 50 \times (.3)^{1.5}$	=	22
$2.7 \times 50 \times (.45)^{1.5}$	=	41
$2.7 \times 100 \times (.5)^{1.5}$	=	95
$2.7 \times 50 \times (.6)^{1.5}$	=	41
$2.7 \times 32 \times (.6)^{1.5}$	=	11
$2.7 \times 1 \times (.6)^{1.5}$	=	-

Σ = 274 CFS

AT ELEV 525.5

$2.7 \times 24 \times (.7)^{1.5}$	=	38
$2.7 \times 25 \times (.7)^{1.5}$	=	40
$2.7 \times 9 \times (.45)^{1.5}$	=	7
$2.7 \times 9 \times (.90)^{1.5}$	=	19
$2.7 \times 15 \times (.55)^{1.5}$	=	17
$2.7 \times 30 \times (.5)^{1.5}$	=	24
$2.7 \times 50 \times (.6)^{1.5}$	=	55
$2.7 \times 50 \times (.8)^{1.5}$	=	71
$2.7 \times 150 \times (.7)^{1.5}$	=	237
$2.7 \times 50 \times (.9)^{1.5}$	=	97
$2.7 \times 50 \times (.90)^{1.5}$	=	125
$2.7 \times 100 \times (1)^{1.5}$	=	270
$2.7 \times 50 \times (.90)^{1.5}$	=	125
$2.7 \times 32 \times (.75)^{1.5}$	=	96
$2.7 \times 4 \times (.3)^{1.5}$	=	2

Σ = 1183 CFS

AT ELEV 526 Σ = 2989 CFS

AT ELEV 527 Σ = 5955 CFS

MAXIMUM KNOWN FLOOD AT DAMSITE

THERE ARE NO RECORDS OF POOL LEVELS FOR THIS DAM. BASED ON THE RECORDS OF THE GAGING STATION FOR CODORUS CREEK AT SPRING GROVE, PA. (D.A. = 75.5 sq mi) THE MAXIMUM DISCHARGE AT THE GAGE OCCURRED IN JUNE 1972 WHEN A DISCHARGE OF 19,400 CFS WAS OBSERVED. THE MAXIMUM INFLOW TO LAKE LEHMAN IS ESTIMATED TO BE:

$$Q = \left(\frac{2.53}{75.5}\right)^{0.8} \times 19400$$

$$= 1282 \text{ CFS}$$

AN ESTIMATE OF THE FLOOD LEVEL FROM THIS STORM, CONTAINED IN THE PENNDER FILES, INDICATED A DEPTH OF FLOW OVER THE WEIR OF 4', OR ABOUT 1257 CFS.

DESIGN FLOOD

SIZE CLASSIFICATION

MAXIMUM STORAGE = 635 ACRE-FEET
MAXIMUM HEIGHT = 52 FEET
SIZE CLASSIFICATION IS "INTERMEDIATE"

HAZARD CLASSIFICATION

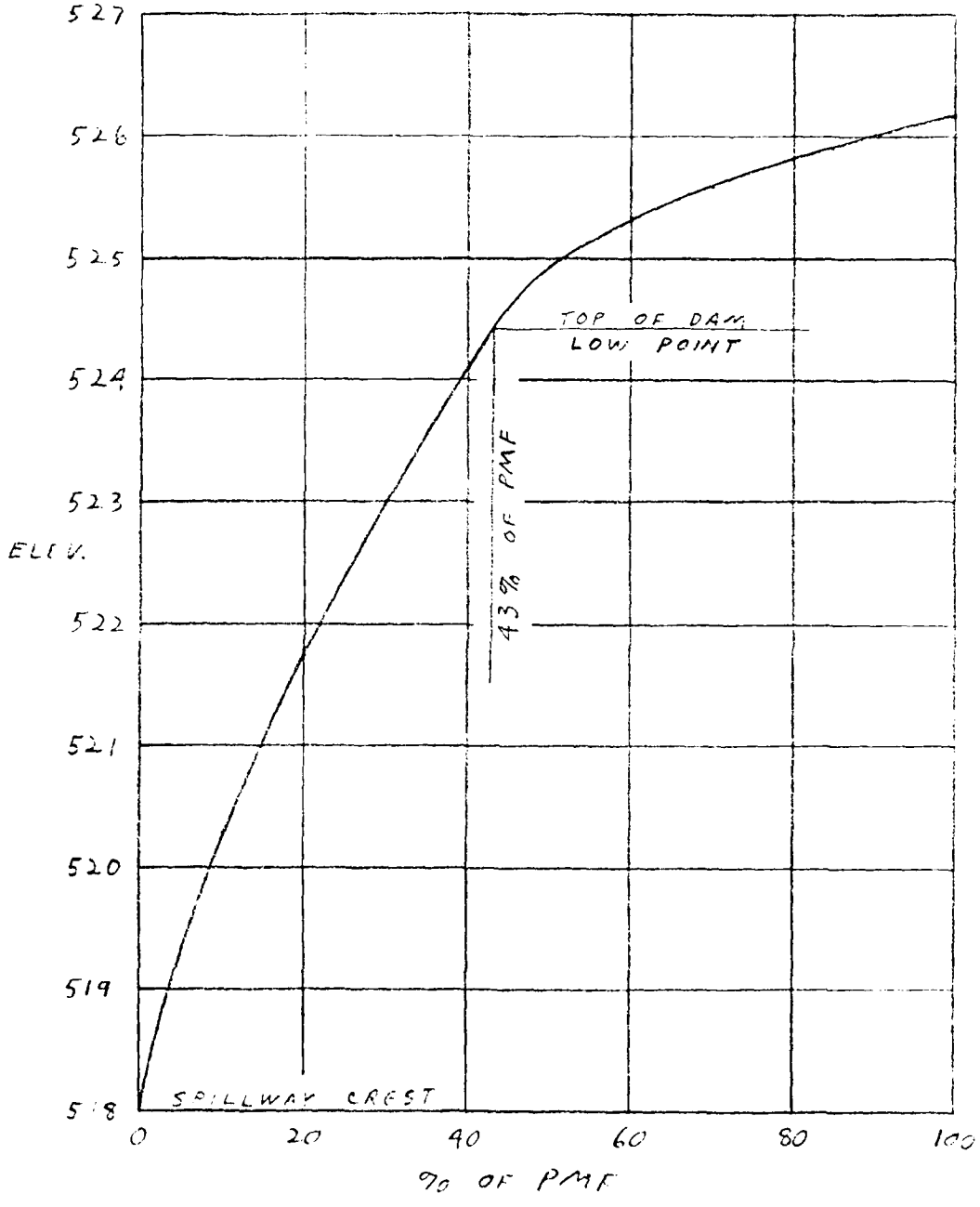
A SMALL DAM AND AN INDUSTRIAL COMPLEX ARE LOCATED ALONG THE DOWNSTREAM CHANNEL.
USE "HIGH"

RECOMMENDED SPILLWAY DESIGN FLOOD

THE ABOVE CLASSIFICATIONS INDICATE USE OF AN SDF EQUAL TO THE PROBABLE MAXIMUM FLOOD.

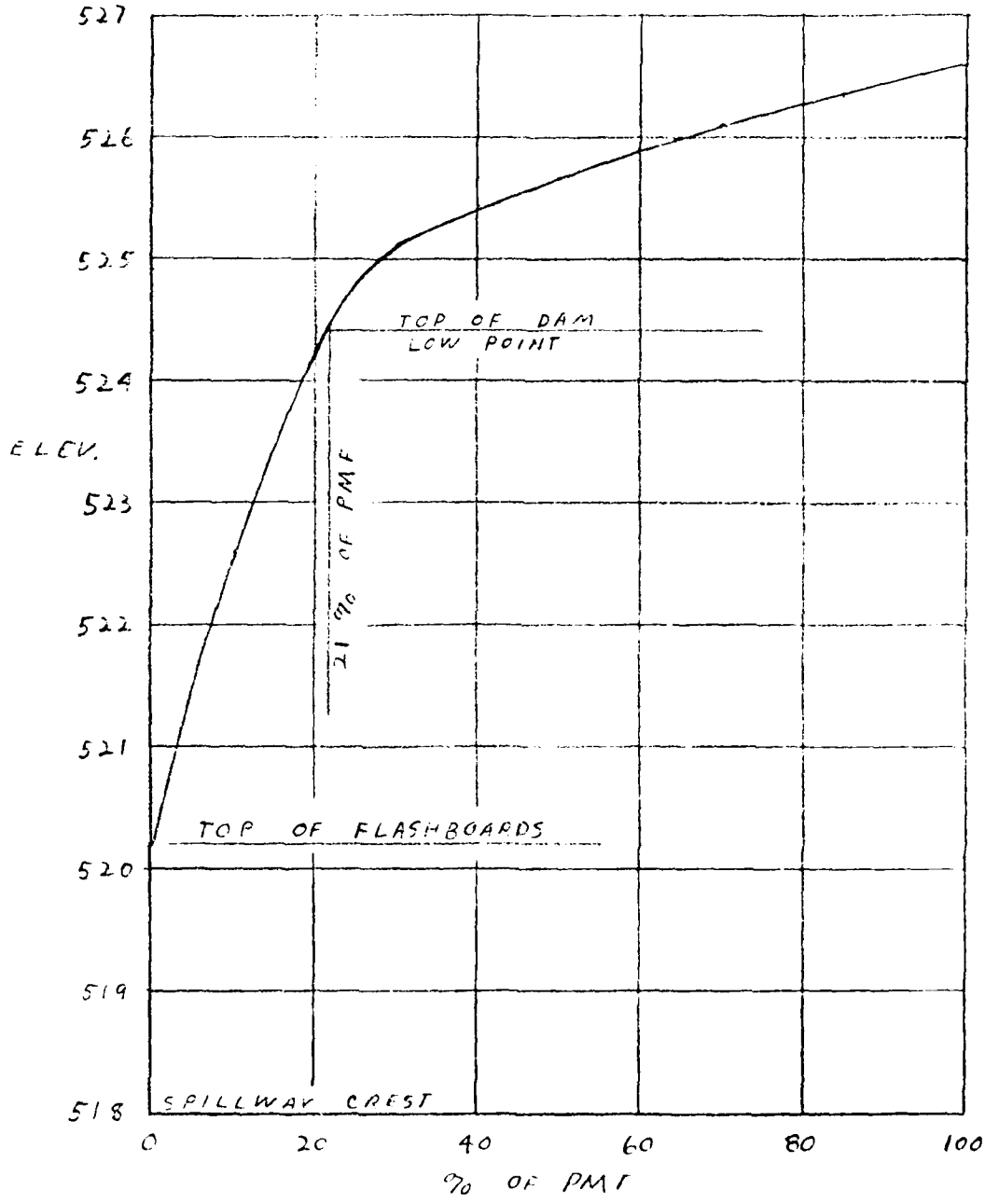
BY RLS DATE 11/25/80 **BERGER ASSOCIATES** SHEET NO. 6 OF 8
CHKD. BY DATE PROJECT 00590
SUBJECT LAKE LEHMAN DAM

SPILLWAY CAPACITY CURVE (WITHOUT FLASHBOARDS)



BY RLC DATE 11/25/85 **BERGER ASSOCIATES** SHEET NO. 7 OF 7
CHKD. BY ..... DATE ..... PROJECT D0590
SUBJECT LAKE LEHMAN DAM

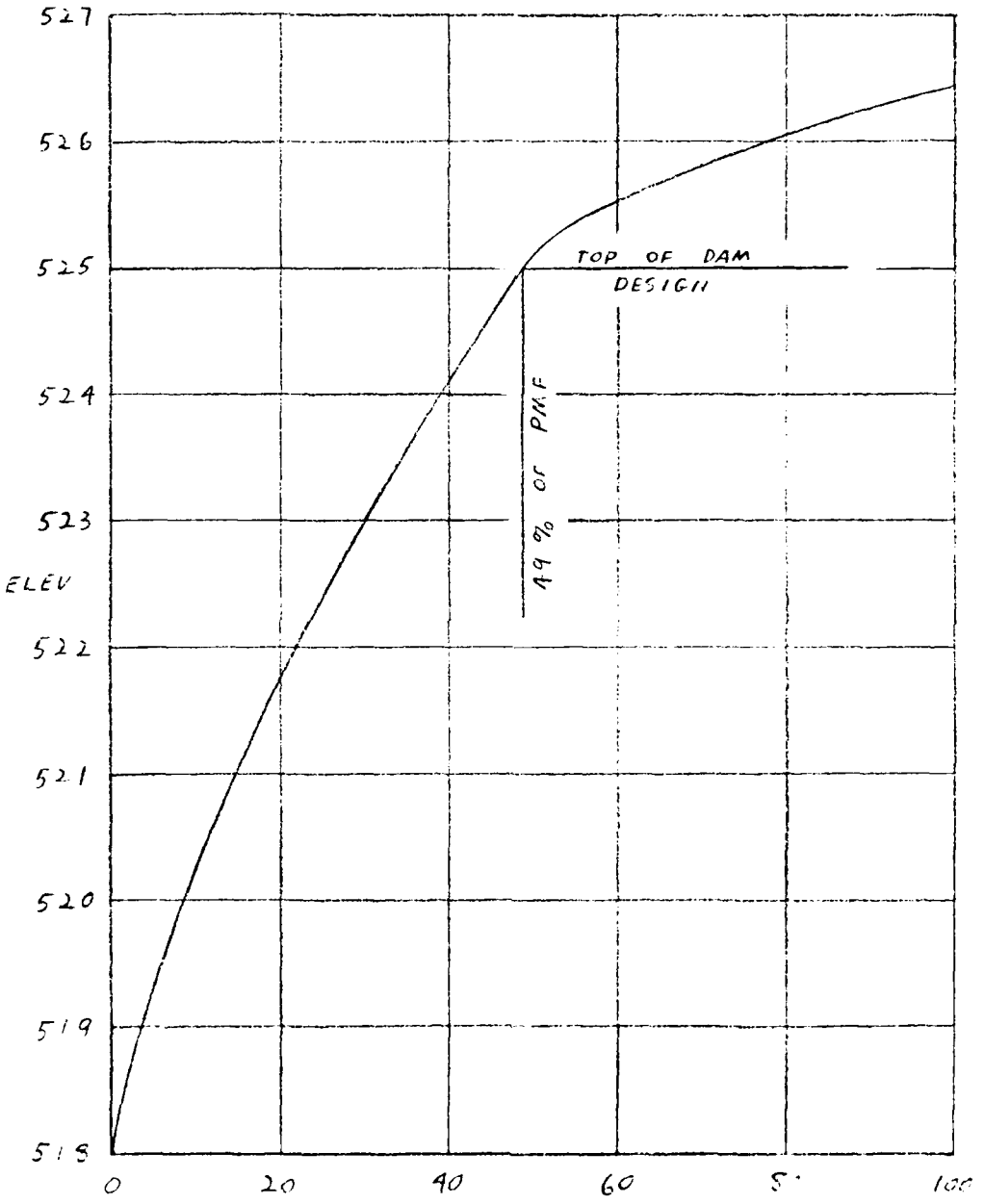
SPILLWAY CAPACITY CURVE (WITH FLASHBOARDS)



BY BLS DATE 2/9/81 **BERGER ASSOCIATES** SHEET NO. 6 OF 8
CHKD. BY DATE PROJECT 00590
SUBJECT LAKE LEIMAN DAM

SPILLWAY CAPACITY CURVE — DESIGN

WITHOUT FLASHBOARDS



HYDROLOGY AND HYDRAULIC ANALYSIS
DATA BASE

NAME OF DAM: Lake Lehman Dam RIVER BASIN: Susquehanna

PROBABLE MAXIMUM PRECIPITATION (PMP) = 23.6 INCHES/24 HOURS (1)

(FOR FOOTNOTES SEE NEXT PAGE)

STATION		1	2	3	4
STATION DESCRIPTION		Lake Lehman	Lake Lehman Dam		
DRAINAGE AREA (SQUARE MILES)		2.53			
CUMULATIVE DRAINAGE AREA (SQUARE MILE)		2.53	2.53		
ADJUSTMENT OF PMP FOR DRAINAGE AREA (%) (2)	6 HOURS	113			
	12 HOURS	123			
	24 HOURS	132			
	48 HOURS	142			
	72 HOURS	---			
	Zone 6				
SNYDER HYDROGRAPH PARAMETERS	ZONE (3)	J.5A			
	C_p / C_t (4)	.54/1.15			
	L (MILES) (5)	2.77			
	L_{ca} (MILES) (5)	1.29			
	$T_p = C_t (L \cdot L_{ca})^{0.3}$ (Hours)	1.69			
				Without	
SPILLWAY DATA	CREST LENGTH (FT.)		Flashboards 40.5	Flashboards 40.5	
	FREEBOARD (FT.)		4.2	6.4	
	DISCHARGE COEFFICIENT		3.3	3.88	
	EXPONENT		1.5	1.5	
	ELEVATION		520.2	518	
AREA (6) (ACRES)	NORMAL POOL (518)	27.5			
	ELEV. 520	39.5			
	ELEV. 540	62.4			
STORAGE (ACRE-FEET)	NORMAL POOL (7) (518)	388.5			
	ELEV. 476 (7) (8)	0			
	ELEV. 500 (7) (8)	86.2			
	ELEV. 520 (8)	455.1			
	540	1465.4			

(1) Hydrometeorological Report 33 (Figure 1), U.S. Army, Corps of Engineers, 1956.

(2) Hydrometeorological Report 33 (Figure 2), U.S. Army, Corps of Engineers, 1956.

(3) Hydrological zone defined by Corps of Engineers, Baltimore District, for determining Snyder's Coefficients (C_p and C_t).

(4) Snyder's Coefficients.

(5) L = Length of longest water course from outlet to basin divide.

L_{ca} = Length of water course from outlet to point opposite the centroid of drainage area.

(6) Planimetered area encompased by contour upstream of dam.

(7) PennDER files.

(8) Computed by conic method.

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FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
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W/FBDS

1

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    1              A1      LAKE LEHMAN DAM    ****    POWDER MILL CREEK
    2              A2      NORTH CODORUS TWP., YORK COUNTY, PA.
    3              A3      NDI # PA-00341      PA DER # 67-480
    4              B   300      0      15       0       0       0       0       0      -4       0
    5              B1    5
    6              J     1      9       1
    7              J1    1    .85      .7      .6      .5      .4      .3      .2      .1
    8              K            1                                       1
    9              K1             INFLOW  HYDROGRAPH
   10              M     1      1    2.53
   11              P           23.6     113     123     132     142
   12              T                                                   1     .05
   13              W  1.69     .54                                     :
   14              K  -1.5    -.05       2
   15              K     1      2                                       1
   16              K1               RESERVOIR  ROUTING
   17              Y                                1
   18              Y1    1                                        455.1      -1
   19              Y4 520.2     521     522     523     524   524.4     525   525.5     526     527
   20              Y5    0      96     323     626     990    1150    1679    2814    4356    8323
   21              $A    0    27.5    39.5    62.4
   22              $E  476     518     520     540
   23              $$ 520.2
   24              $D 524.4
   25              K    99
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1 PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 1
ROUTE HYDROGRAPH TO 2
END OF NETWORK

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1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION     JULY 1978
   LAST MODIFICATION  26 FEB 79
 **********************************

 RUN  DATE= 80/11/20.
      TIME= 06.40.30.
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LAKE LEHMAN DAM **** POWDER MILL CREEK
NORTH CODORUS TWP., YORK COUNTY, PA.
NDI # PA-00341 PA DER # 67-480

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS= 1.00 .85 .70 .60 .50 .40 .30 .20 .10

********** ********** ********** ********** **********

2

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.53	0.00	2.53	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.60	113.00	123.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.69 CP= .54 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 48 END-OF-PERIOD ORDINATES, LAG= 1.69 HOURS, CP= .54 VOL= 1.00

27.	100.	200.	315.	420.	493.	527.	507.	454.	402.
355.	314.	278.	246.	218.	193.	170.	151.	133.	118.
104.	92.	82.	72.	64.	57.	50.	44.	39.	35.
31.	27.	24.	21.	19.	17.	15.	13.	12.	10.
9.	8.	7.	6.	6.	5.	4.	4.		

0

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

	RAIN	EXCS	LOSS	COMP Q
SUM	26.81	24.41	2.40	161309.
	(681.)	(620.)	(61.)	(4567.76)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	455.	-1

STAGE	520.20	521.00	522.00	523.00	524.00	524.40	525.00	525.50	526.00	527.00
FLOW	0.00	96.00	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

HYDROGRAPH ROUTING

RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	455.	-1

STAGE	520.20	521.00	522.00	523.00	524.00	524.40	525.00	525.50	526.00	527.00
FLOW	0.00	96.00	323.00	626.00	990.00	1150.00	1679.00	2814.00	4356.00	8323.00
SURFACE AREA=	0.	28.	40.	62.						
CAPACITY=	0.	385.	452.	1462.						
ELEVATION=	476.	518.	520.	540.						

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
520.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
524.4	0.0	0.0	0.

PEAK OUTFLOW IS 6757. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 5744. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 4730. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 4040. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 3365. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 2653. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 1904. AT TIME 42.00 HOURS

PEAK OUTFLOW IS 1038. AT TIME 42.75 HOURS

PEAK OUTFLOW IS 509. AT TIME 43.00 HOURS

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1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				1.00	.85	.70	.60	.50	.40	.30	.20	.10
HYDROGRAPH AT	1	2.53	1	6789.	5771.	4752.	4073.	3394.	2716.	2037.	1358.	679.
	(	6.55)	(	192.24)(	163.40)(	134.57)(	115.34)(	96.12)(	76.90)(	57.67)(	38.45)(	19.22)
ROUTED TO	2	2.53	1	6757.	5744.	4730.	4040.	3365.	2653.	1904.	1088.	509.
	(	6.55)	(	191.33)(	162.64)(	133.94)(	114.39)(	95.29)(	75.14)(	53.91)(	30.80)(	14.42)

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	520.07	520.20	524.40
STORAGE	454.	460.	635.
OUTFLOW	0.	0.	1150.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	526.61	2.21	735.	6757.	8.50	41.50	0.00
.85	526.35	1.95	723.	5744.	7.75	41.50	0.00
.70	526.09	1.69	712.	4730.	7.00	41.50	0.00
.60	525.90	1.50	703.	4040.	6.25	41.50	0.00
.50	525.68	1.28	693.	3365.	5.50	41.50	0.00
.40	525.43	1.03	681.	2653.	4.50	41.50	0.00
.30	525.10	.70	667.	1904.	3.50	42.00	0.00
.20	524.24	0.00	629.	1088.	0.00	42.75	0.00
.10	522.61	0.00	558.	509.	0.00	43.00	0.00

EOI ENCOUNTERED.
N>
IDLE
N>

W01FBD5

5

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DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************
    1             A1     LAKE LEHMAN DAM    ****    POWDER MILL CREEK
    2             A2     NORTH CODORUS TWP., YORK COUNTY, PA.
    3             A3     NDI # PA-00341      PA DER # 67-480
    4             B   300      0     15      0      0      0      0      0     -4      0
    5             B1    5
    6             J     1      9      1
    7             J1    1    .85     .7     .6     .5     .4     .3     .2     .1
    8             K           1                                   1
    9             K1             INFLOW  HYDROGRAPH
   10             M     1      1   2.53
   11             P          23.6    113    123    132    142
   12             T                                           1    .05
   13             W  1.69    .54
   14             X  -1.5   -.05      2
   15             K     1      2                                   1
   16             K1             RESERVOIR  ROUTING
   17             Y                            1
   18             Y1    1                                   388.5     -1
   19             Y4  518   518.5    519    520    521    522    523    524   524.4    525
   20             Y4 525.5    526    527
   21             Y5    0     56    157    444    816   1257   1757   2309   2544   3184
   22             Y5 4411   6045  10196
   23             $A    0   27.5   39.5   62.4
   24             $E  476    518    520    540
   25             $$  518
   26             $D 524.4
   27             K    99
1                          PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                                RUNOFF HYDROGRAPH AT          1
                                ROUTE HYDROGRAPH TO           2
                                END OF NETWORK

1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION     JULY 1978
   LAST MODIFICATION  26 FEB 79
 **********************************

 RUN  DATE* 80/11/20.
      TIME* 06.26.24.


                     LAKE LEHMAN DAM    ****    POWDER MILL CREEK
                     NORTH CODORUS TWP., YORK COUNTY, PA.
                     NDI # PA-00341      PA DER # 67-480

                                  JOB SPECIFICATION
                  NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
                 300       0      15       0       0       0       0       0      -4       0
                                      JOPER     NWT   LROPT   TRACE
                                         5       0       0       0


                              MULTI-PLAN ANALYSES TO BE PERFORMED
                                  NPLAN= 1 NRTIO= 9 LRTIO= 1
                RTIOS=   1.00     .85     .70     .60     .50     .40     .30     .20     .10
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********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.53	0.00	2.53	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.60	113.00	123.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.69 CP= .54 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 48 END-OF-PERIOD ORDINATES, LAG= 1.69 HOURS, CP= .54 VOL= 1.00

27.	100.	200.	315.	420.	493.	527.	507.	454.	402.
355.	314.	278.	246.	218.	193.	170.	151.	133.	118.
104.	92.	82.	72.	64.	57.	50.	44.	39.	35.
31.	27.	24.	21.	19.	17.	15.	13.	12.	10.
9.	8.	7.	6.	6.	5.	4.	4.		

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	26.81	24.41	2.40	161309.
										(681.)	(620.)	(61.)	(4567.76)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	389.	-1

STAGE	518.00	518.50	519.00	520.00	521.00	522.00	523.00	524.00	524.40	525.00
	525.50	526.00	527.00							
FLOW	0.00	56.00	157.00	444.00	816.00	1257.00	1757.00	2309.00	2544.00	3184.00
	4411.00	6045.00	10196.00							

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	389.	-1

STAGE	518.00	518.50	519.00	520.00	521.00	522.00	523.00	524.00	524.40	525.00
	525.50	526.00	527.00							
FLOW	0.00	56.00	157.00	444.00	816.00	1257.00	1757.00	2309.00	2544.00	3184.00
	4411.00	6045.00	10196.00							
SURFACE AREA=	0.	28.	40.	62.						
CAPACITY=	0.	385.	452.	1462.						
ELEVATION=	476.	518.	520.	540.						

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
518.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
524.4	0.0	0.0	0.

PEAK OUTFLOW IS 6760. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 5728. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 4701. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 3956. AT TIME 41.75 HOURS

PEAK OUTFLOW IS 3106. AT TIME 42.00 HOURS

PEAK OUTFLOW IS 2368. AT TIME 42.25 HOURS

PEAK OUTFLOW IS 1749. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 1142. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 548. AT TIME 42.75 HOURS

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1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				1.00	.85	.70	.60	.50	.40	.30	.20	.10
HYDROGRAPH AT	1	2.53	1	6789.	5771.	4752.	4073.	3394.	2716.	2037.	1358.	679.
	(	6.55)	(	192.24)(	163.40)(	134.57)(	115.34)(	96.12)(	76.90)(	57.67)(	38.45)(	19.22
ROUTED TO	2	2.53	1	6760.	5728.	4701.	3956.	3106.	2368.	1749.	1142.	548.
	(	6.55)	(	191.42)(	162.21)(	133.13)(	112.01)(	87.96)(	67.04)(	49.51)(	32.35)(	15.53

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	518.11	518.00	524.40
STORAGE	388.	385.	635.
OUTFLOW	12.	0.	2544.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	526.17	1.77	715.	6760.	5.25	41.50	0.00
.85	525.90	1.50	703.	5728.	4.50	41.50	0.00
.70	525.59	1.19	689.	4701.	3.75	41.50	0.00
.60	525.31	.91	676.	3956.	3.00	41.75	0.00
.50	524.93	.53	659.	3106.	2.00	42.00	0.00
.40	524.10	0.00	622.	2368.	0.00	42.25	0.00
.30	522.98	0.00	574.	1749.	0.00	42.50	0.00
.20	521.74	0.00	522.	1142.	0.00	42.50	0.00
.10	520.28	0.00	463.	548.	0.00	42.75	0.00

EOI ENCOUNTERED.
N>
IDLE
N>

9

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A1      LAKE LEHMAN DAM    ****    POWDER MILL CREEK
A2      NORTH CODORUS TWP., YORK COUNTY, PA.
A3      NDI # PA-00341      PA DER # 67-480
B    300       0      15       0       0       0       0       0      -4       0
B1     5
J      1       9       1
J1     1     .85      .7      .6      .5      .4      .3      .2      .1
K              1                                       1
K1                INFLOW  HYDROGRAPH
M      1       1    2.53
P           23.6     113     123     132     142
T                                                      1     .05
W   1.69     .54
X   -1.5    -.05       2
K      1       2                                       1
K1                RESERVOIR  ROUTING
Y                              1
Y1     1                                           388.5       0
$A     0    27.5    39.5    62.4
$E   476     518     520     540
$$   518    40.5    3.88     1.5
$D   525     2.7     1.5     645
K     99
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1 PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

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RUNOFF HYDROGRAPH AT          1
ROUTE HYDROGRAPH TO           2
END OF NETWORK
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1**********************************
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
 *********************************

 RUN  DATE* 80/11/25.
      TIME* 05.42.10.
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LAKE LEHMAN DAM    ****    POWDER MILL CREEK
NORTH CODORUS TWP., YORK COUNTY, PA.
NDI # PA-00341      PA DER # 67-480
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JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	15	0	0	0	0	0	-4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1
RTIOS=   1.00   .85   .70   .60   .50   .40   .30   .20   .10

```
**********     **********     **********     **********     **********
```

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.53	0.00	2.53	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.60	113.00	123.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.69 CP= .54 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 48 END-OF-PERIOD ORDINATES, LAG= 1.69 HOURS, CP= .54 VOL= 1.00

27.	100.	200.	315.	420.	493.	527.	507.	454.	402.
355.	314.	278.	246.	218.	193.	170.	151.	133.	118.
104.	92.	82.	72.	64.	57.	50.	44.	39.	35.
31.	27.	24.	21.	19.	17.	15.	13.	12.	10.
9.	8.	7.	6.	6.	5.	4.	4.		

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	26.81	24.41	2.40	181309.
										(681.)	(620.)	(61.)	(4567.76)

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	389.	0

SURFACE AREA=	0.	28.	40.	62.
CAPACITY=	0.	385.	452.	1482.

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	2.53	0.00	2.53	0.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.60	113.00	123.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 1.69 CP= .54 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 48 END-OF-PERIOD ORDINATES, LAG= 1.69 HOURS, CP= .54 VOL= 1.00

27.	100.	200.	315.	420.	493.	527.	507.	454.	402.
355.	314.	278.	246.	218.	193.	170.	151.	133.	118.
104.	92.	82.	72.	64.	57.	50.	44.	39.	35.
31.	27.	24.	21.	19.	17.	15.	13.	12.	10.
9.	8.	7.	6.	6.	5.	4.	4.		

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	26.81	24.41	2.40	161309.
										(681.)(620.)(61.)(4567.76)			

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSAK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	339.	0

SURFACE AREA=	0.	28.	40.	62.
CAPACITY=	0.	385.	452.	1462.

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

RESERVOIR ROUTING

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	0	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	389.	0

SURFACE AREA=	0.	28.	40.	62.
CAPACITY=	0.	385.	452.	1462.
ELEVATION=	476.	518.	520.	540.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
518.0	40.5	3.9	1.5	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
525.0	2.7	1.5	645.

PEAK OUTFLOW IS 6753. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 5731. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 4683. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 3931. AT TIME 41.75 HOURS

PEAK OUTFLOW IS 3035. AT TIME 42.25 HOURS

PEAK OUTFLOW IS 2371. AT TIME 42.25 HOURS

PEAK OUTFLOW IS 1752. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 1143. AT TIME 42.50 HOURS

PEAK OUTFLOW IS 548. AT TIME 42.75 HOURS

********** ********** ********** ********** **********

1 ********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .85	RATIO 3 .70	RATIO 4 .60	RATIO 5 .50	RATIO 6 .40	RATIO 7 .30	RATIO 8 .20	RATIO 9 .10
HYDROGRAPH AT	1	2.53	1	6789.	5771.	4752.	4073.	3394.	2716.	2037.	1358.	679.
	(	6.55)	(	192.24)(	163.40)(	134.57)(	115.34)(	96.12)(	76.90)(	57.67)(	38.45)(	19.22)
ROUTED TO	2	2.53	1	6753.	5731.	4683.	3931.	3035.	2371.	1752.	1143.	548.
	(	6.55)	(	191.21)(	162.29)(	132.62)(	111.30)(	85.93)(	67.13)(	49.60)(	32.38)(	15.52)

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

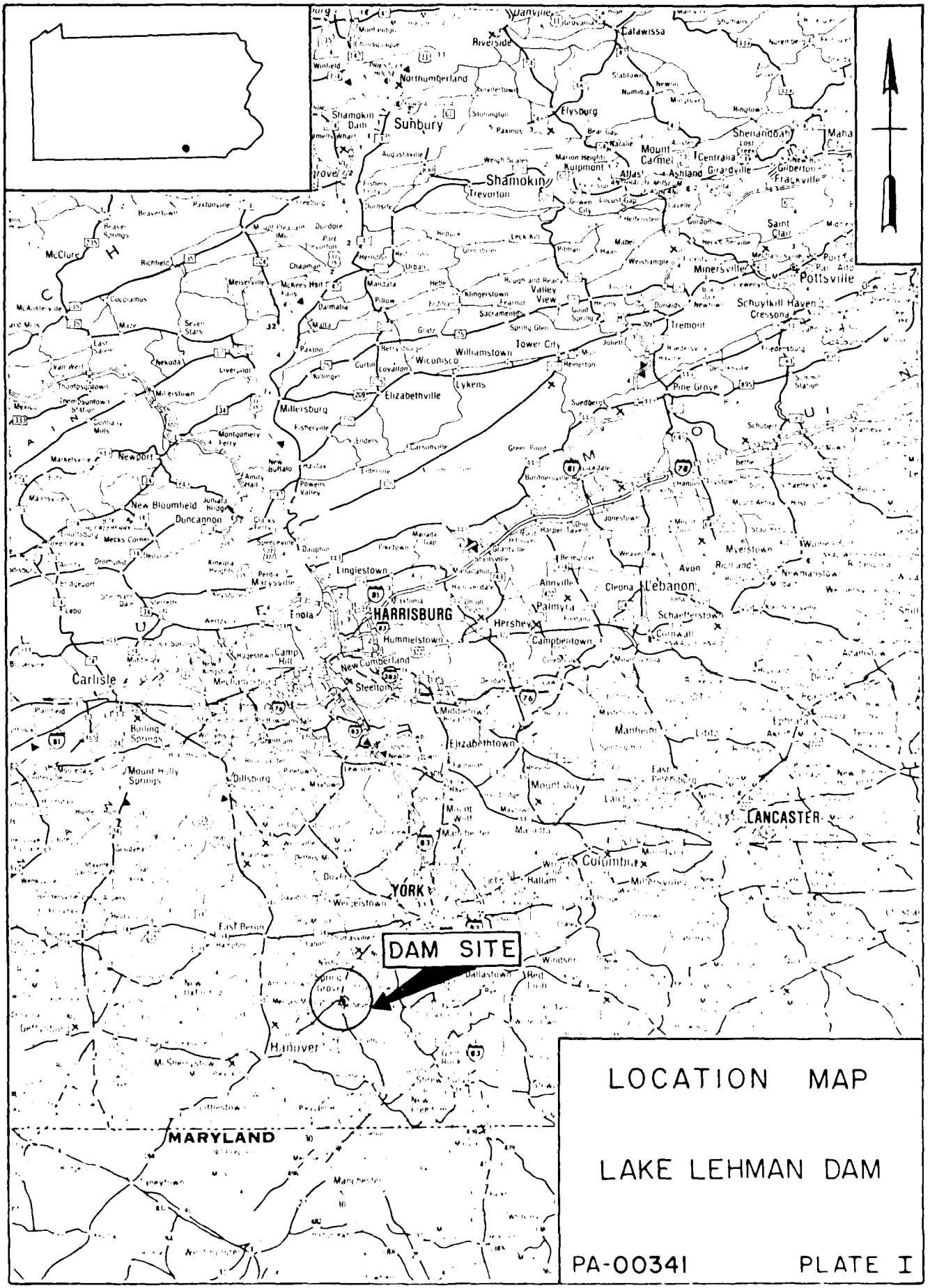
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	518.11	518.00	525.00
STORAGE	388.	395.	662.
OUTFLOW	5.	0.	2910.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	526.41	1.41	726.	6753.	4.50	41.50	0.00
.85	526.13	1.13	713.	5731.	4.00	41.50	0.00
.70	525.80	.80	698.	4683.	3.25	41.50	0.00
.60	525.53	.53	686.	3931.	2.25	41.75	0.00
.50	525.10	.10	667.	3035.	.75	42.25	0.00
.40	524.11	0.00	622.	2371.	0.00	42.25	0.00
.30	522.99	0.00	574.	1752.	0.00	42.50	0.00
.20	521.75	0.00	523.	1143.	0.00	42.50	0.00
.10	520.30	0.00	464.	548.	0.00	42.75	0.00

EOI ENCOUNTERED.
N>

APPENDIX E

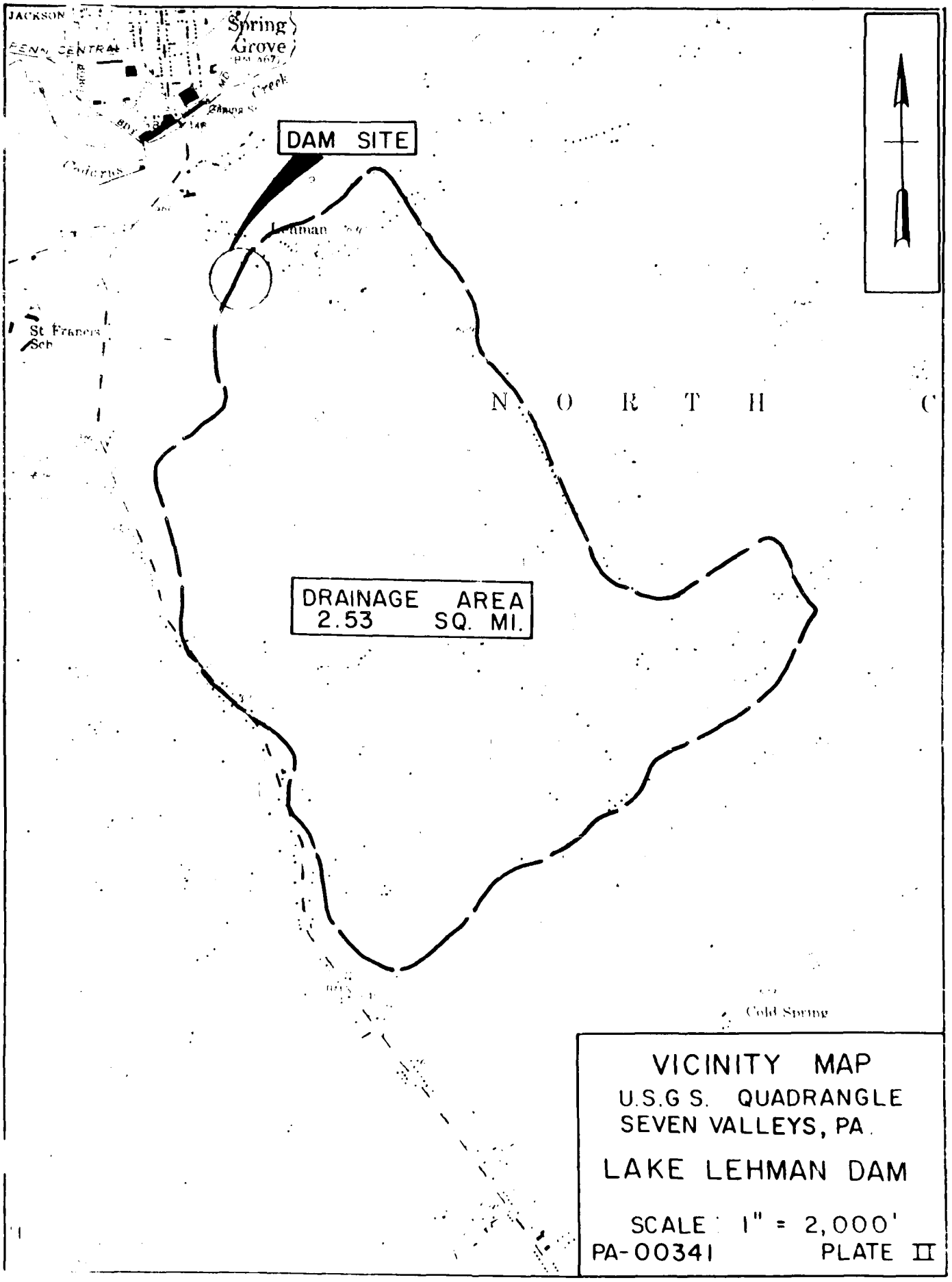
PLATES



LOCATION MAP

LAKE LEHMAN DAM

PA-00341 PLATE I

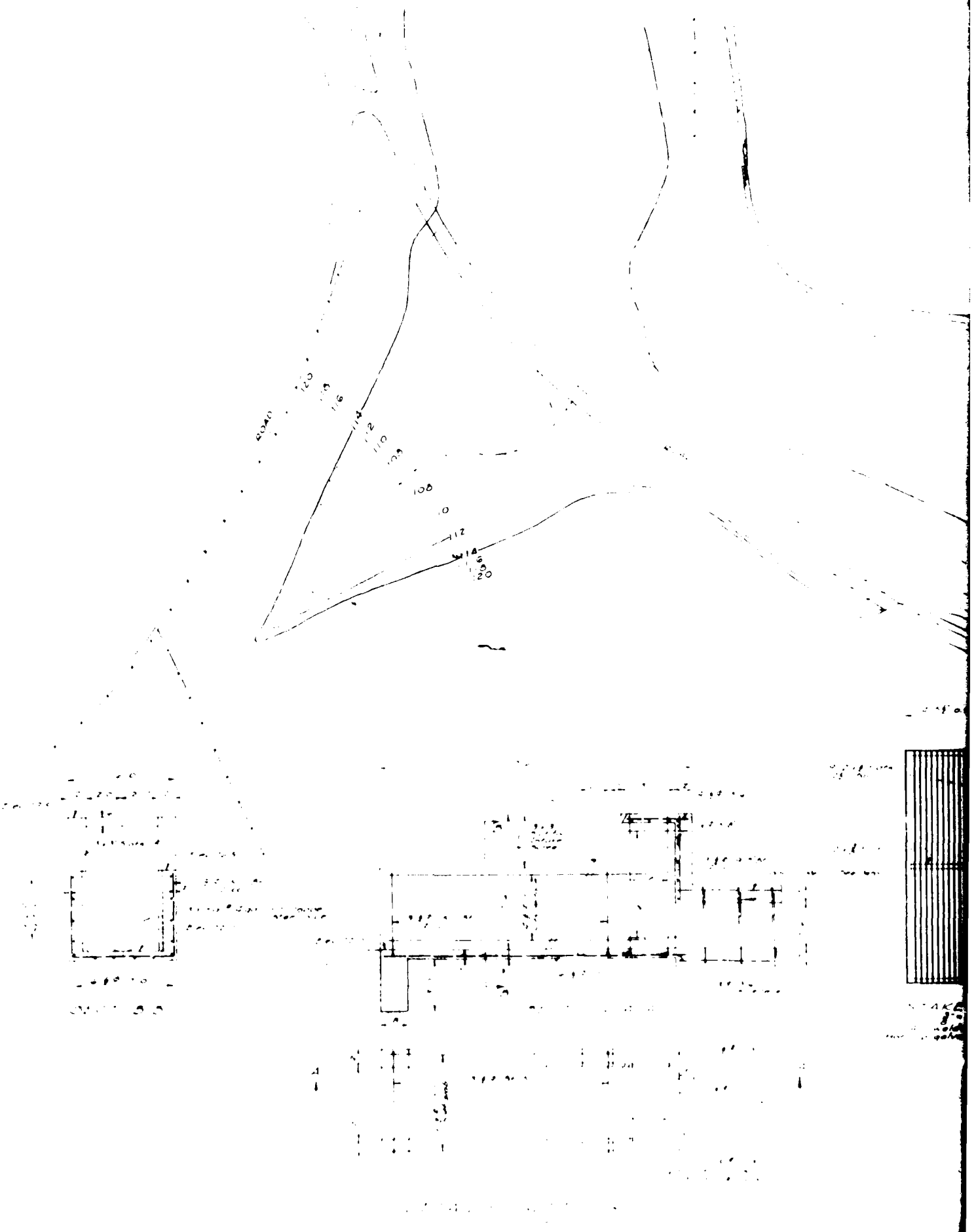


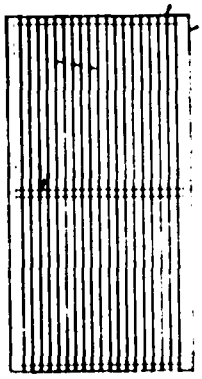
VICINITY MAP
U.S.G.S. QUADRANGLE
SEVEN VALLEYS, PA.

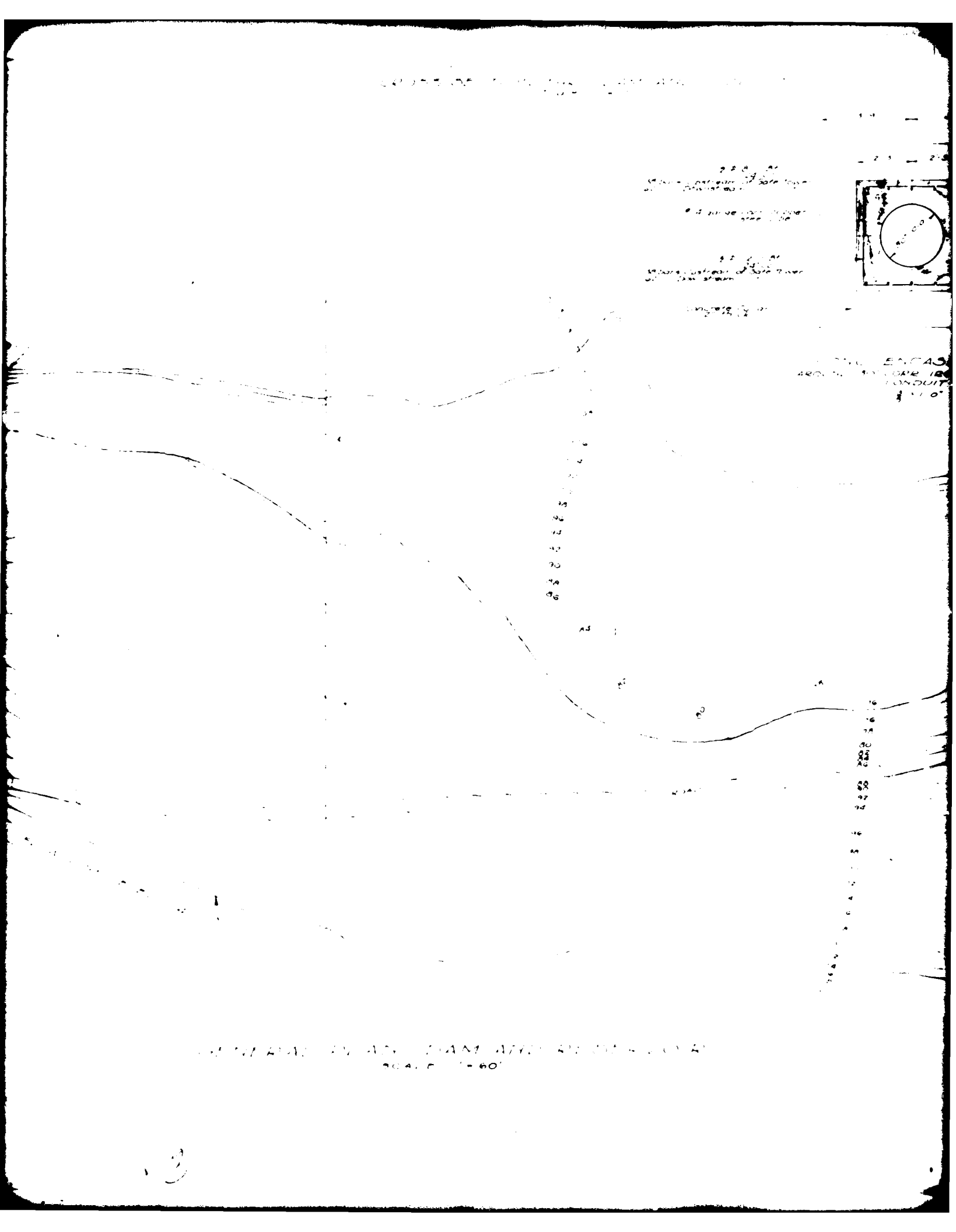
LAKE LEHMAN DAM

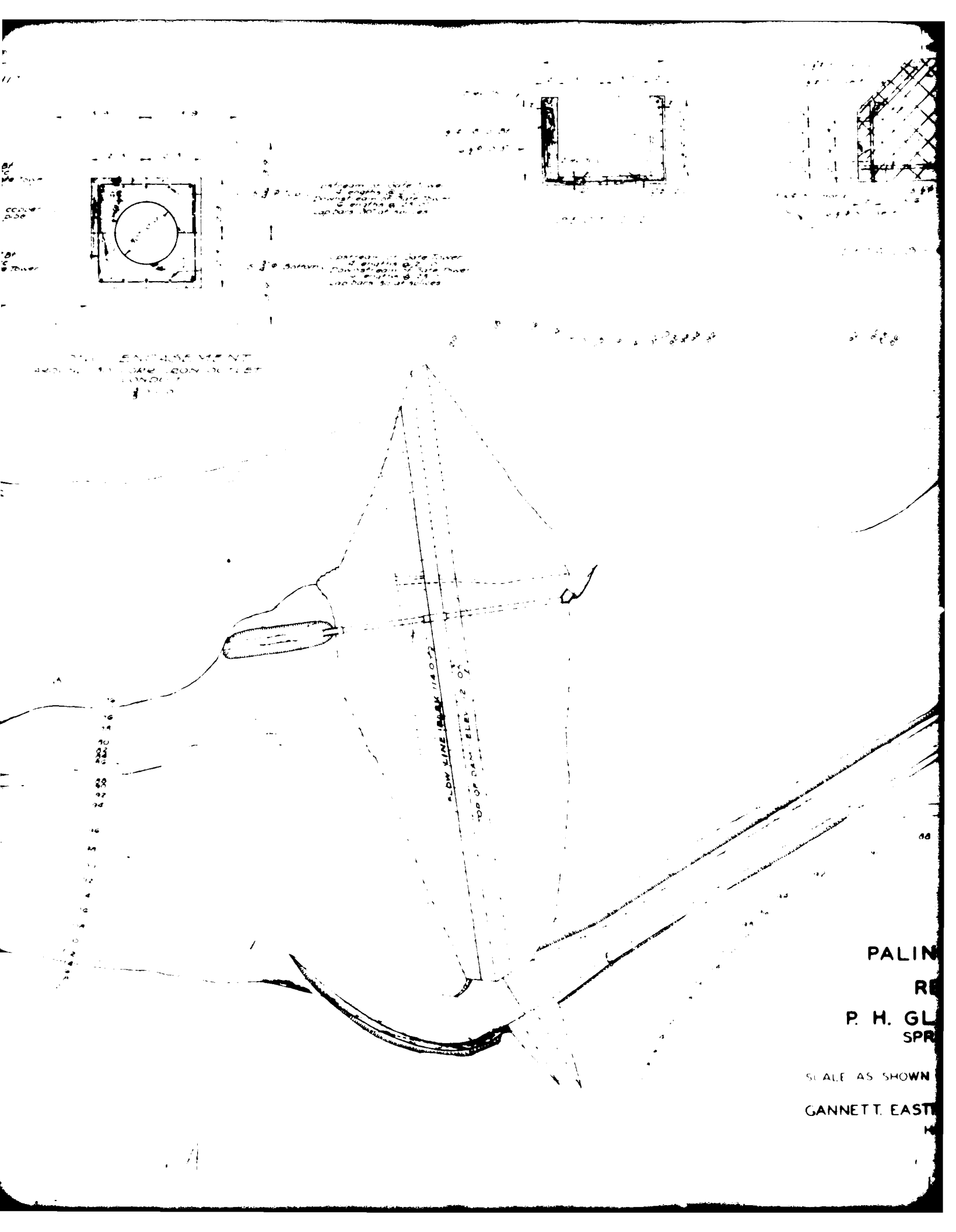
SCALE 1" = 2,000'

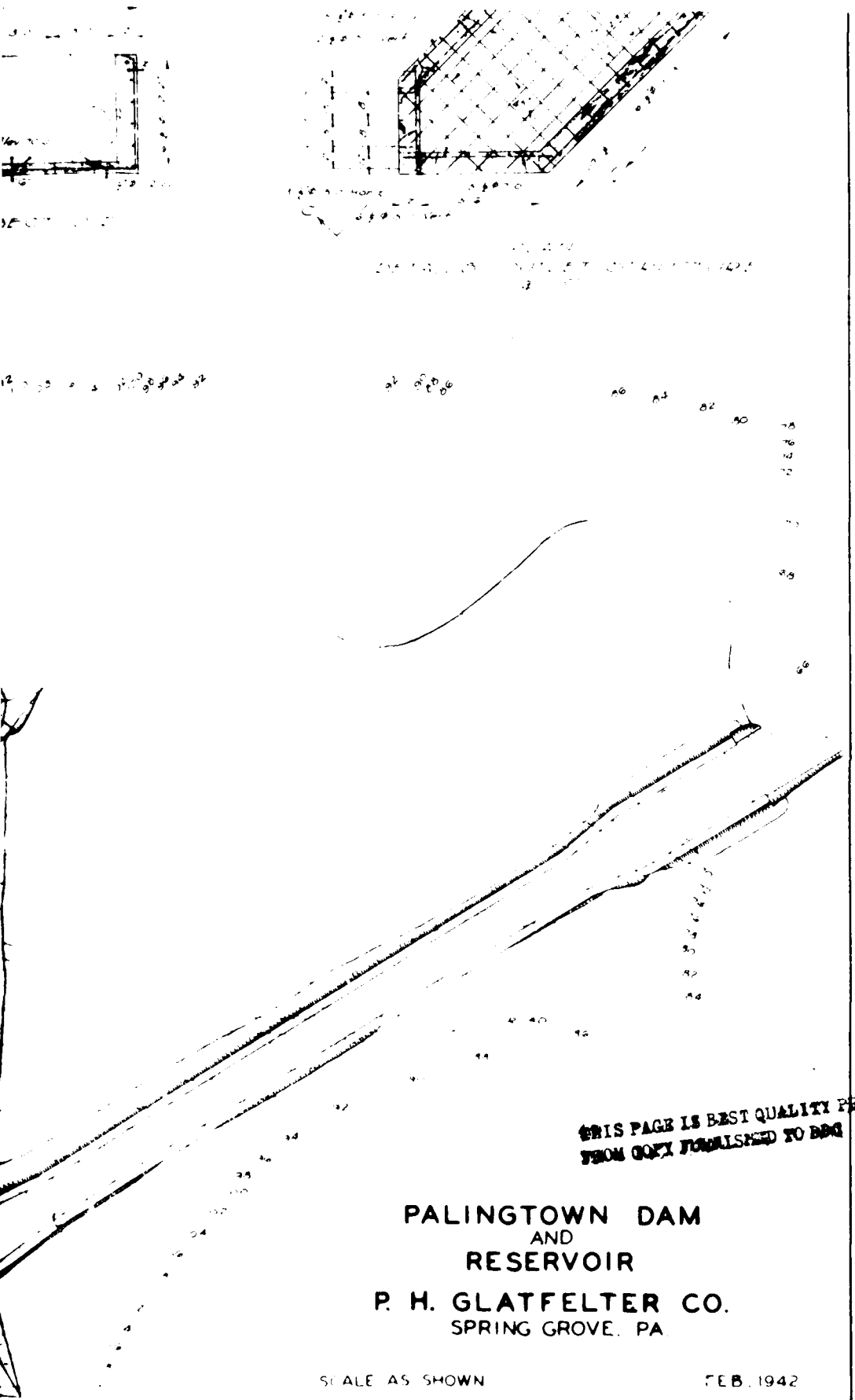
PA-00341 PLATE II








PALIN
P. H. GL
SPR
SCALE AS SHOWN
GANNETT EAST



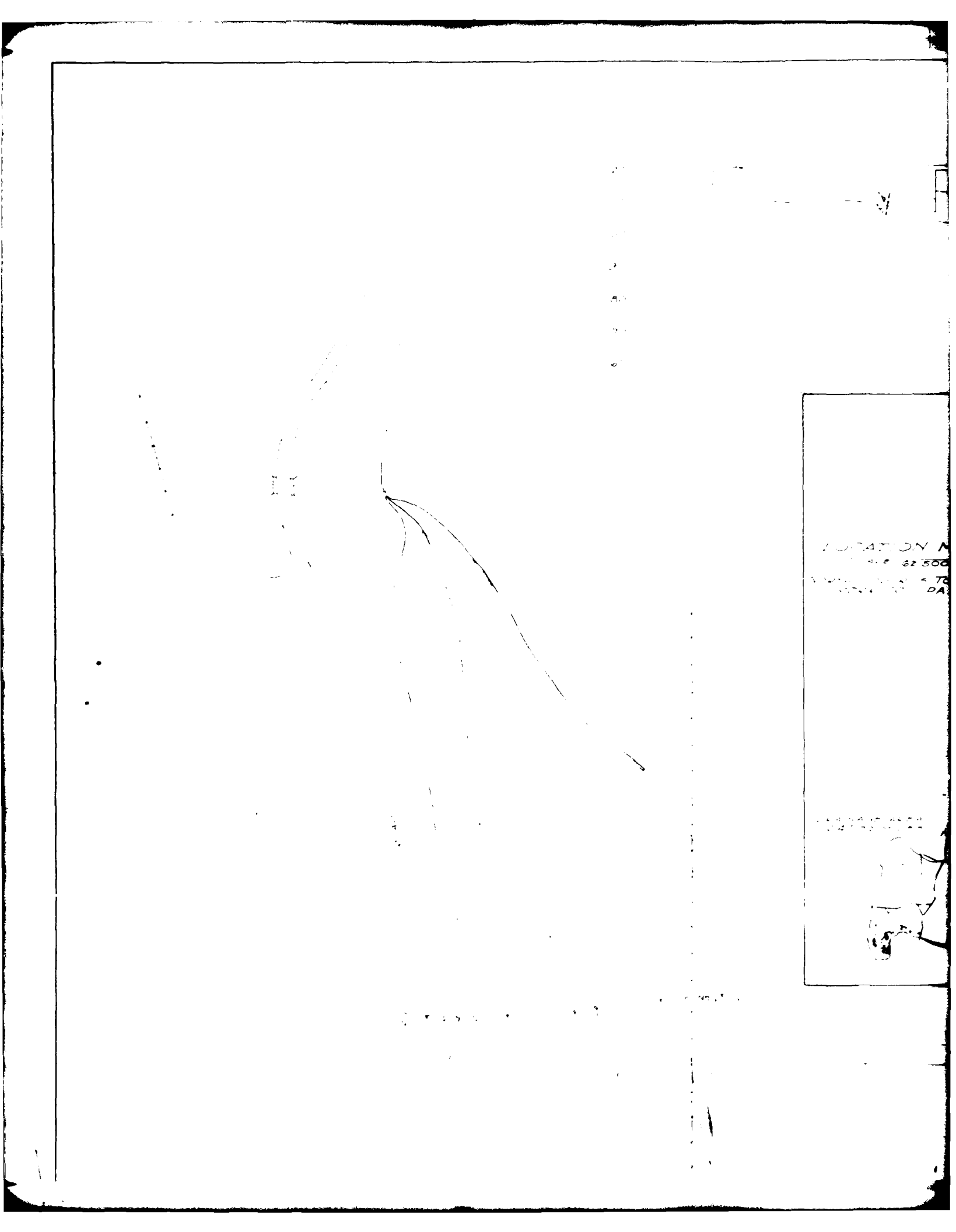
PALINGTOWN DAM
AND
RESERVOIR

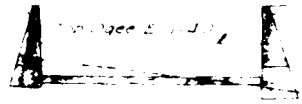
P. H. GLATFELTER CO.
SPRING GROVE, PA

SCALE AS SHOWN FEB. 1942

GANNETT, EASTMAN & FLEMING, INC., ENGRS
HARRISBURG, PA

PA-00341
PLATE III





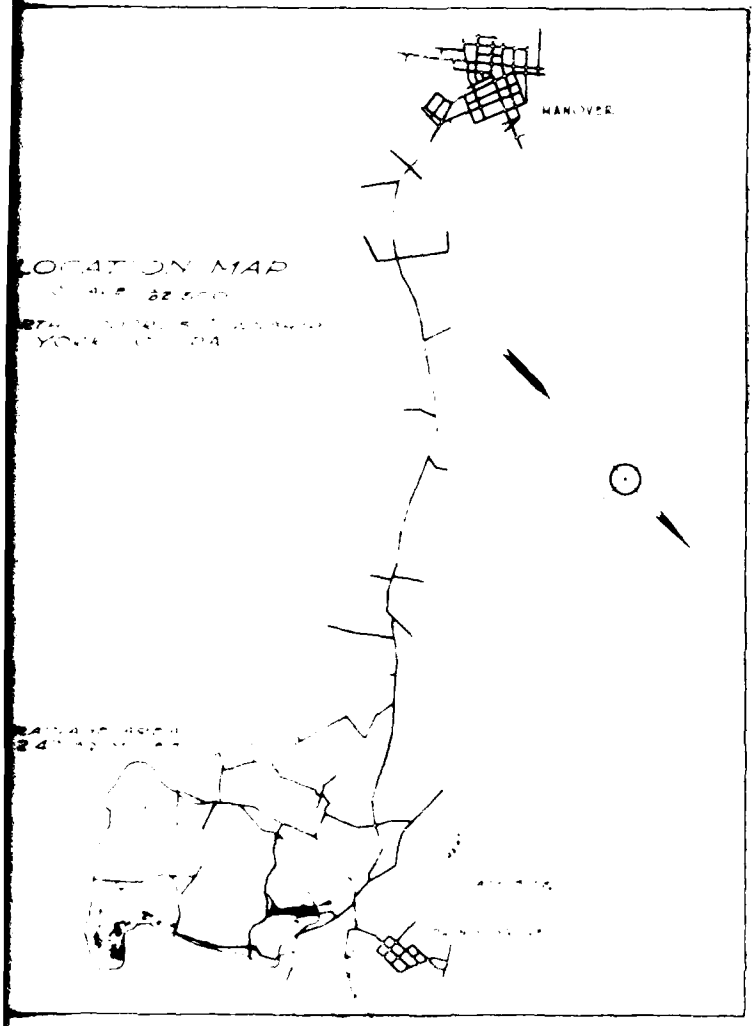
Top Cut Off Wall

Bottom Cut-Off Trench

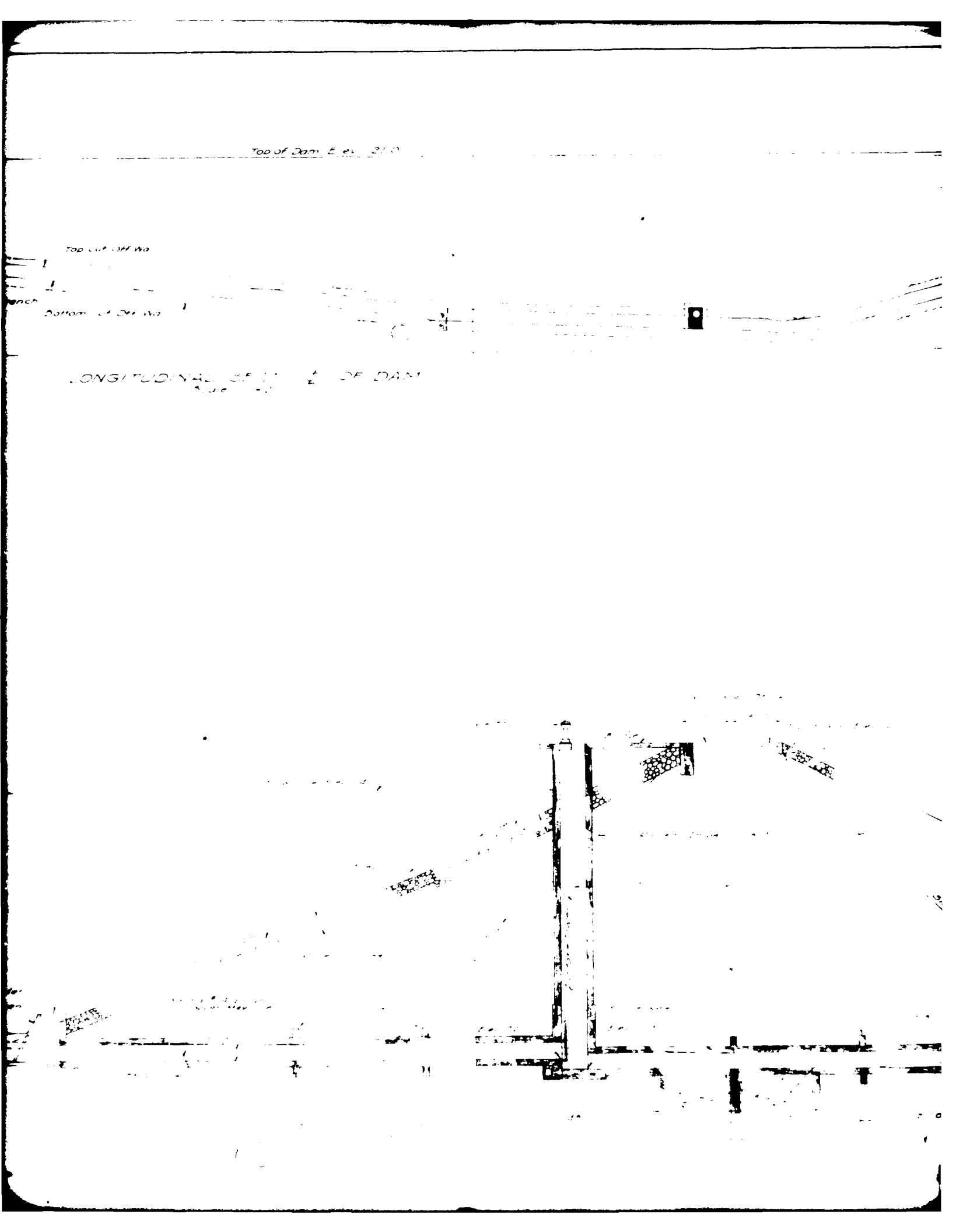
Bottom Cut-Off Wall

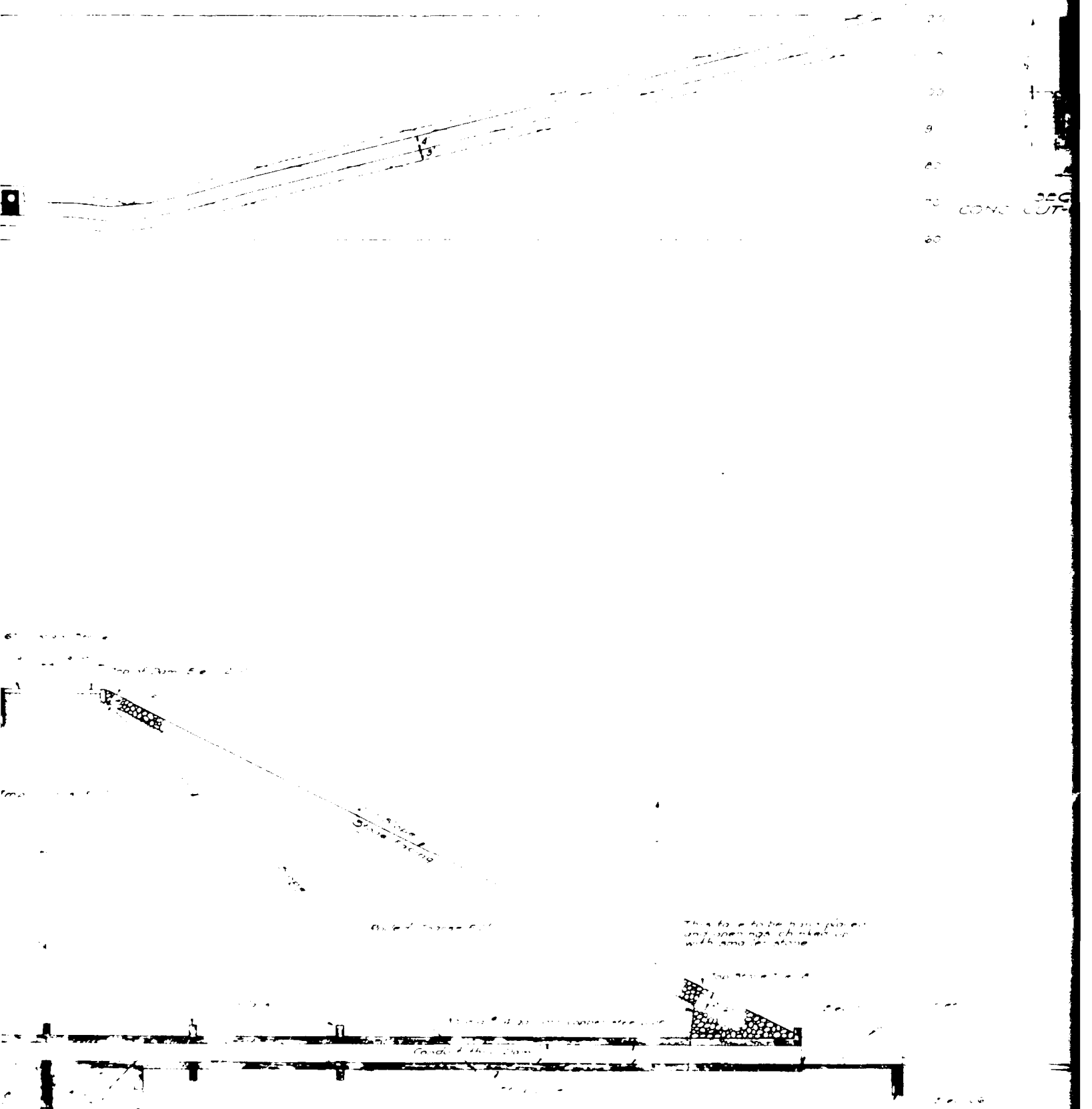
LONGITUDINAL SE

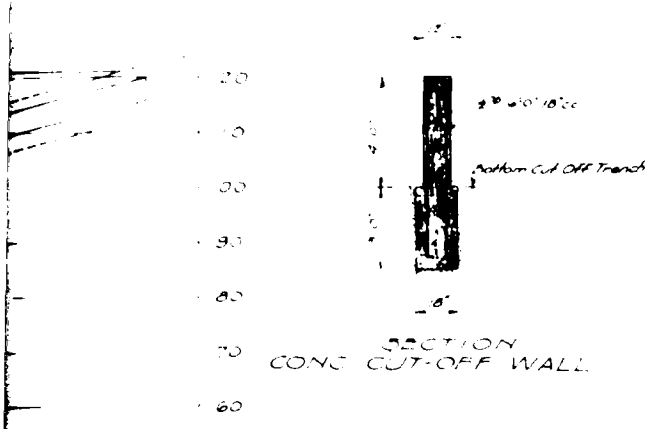
Scale - 1"



LOCATION MAP

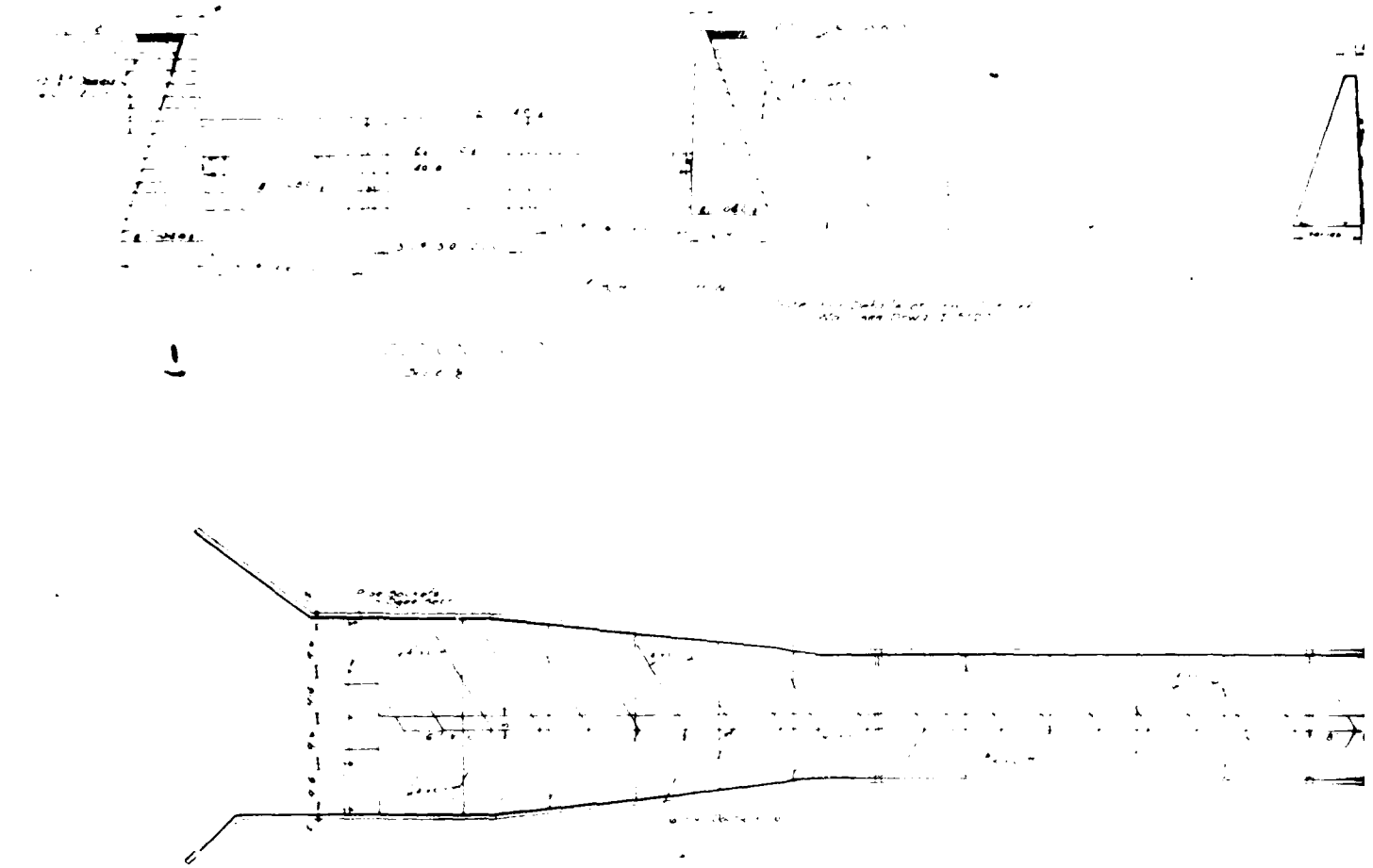

Top of Dam El. 210
Top Cut-off Wall
Bottom of Cut-off Wall
LONGITUDINAL SECTION OF DAM

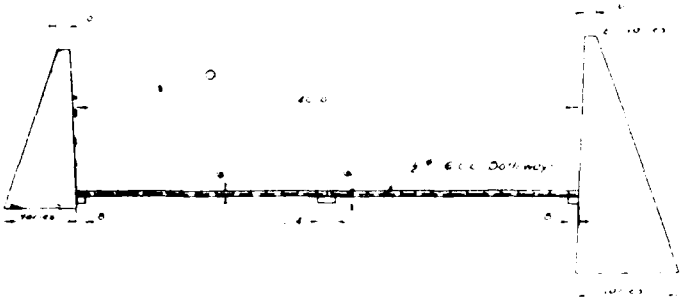




SECTION
CONC CUT-OFF WALL

PA-00341
PLATE IV





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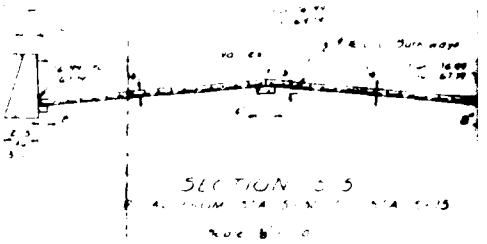

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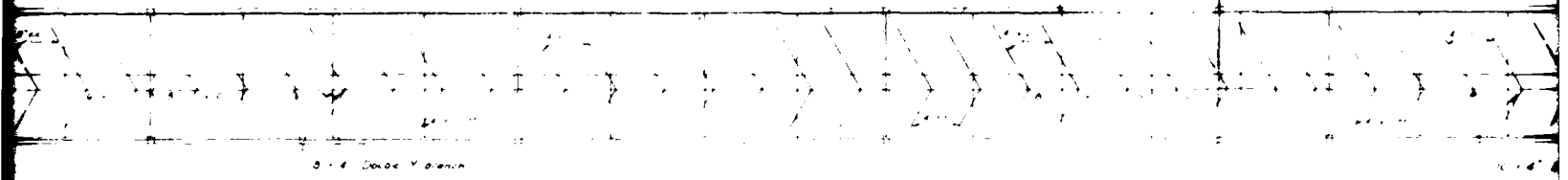
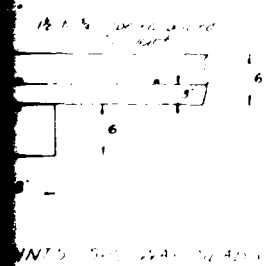
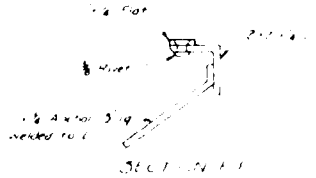


PLAN OF SPILLWAY SHOWING UNDERDRAINS





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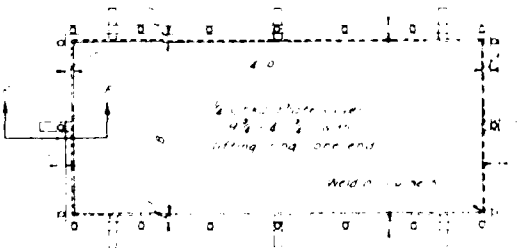
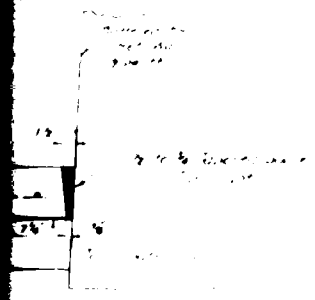
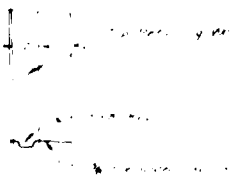
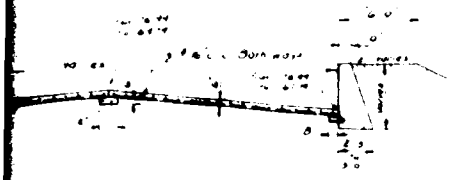


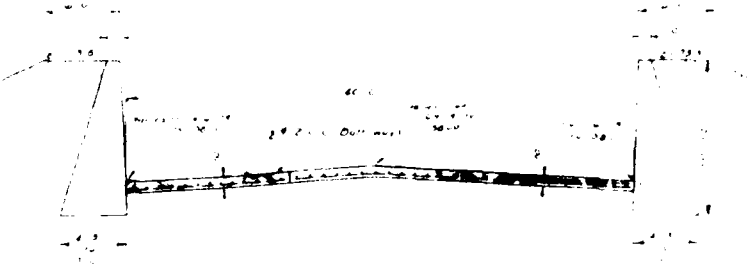
TYPICAL MANHOLE FRAME & COVER

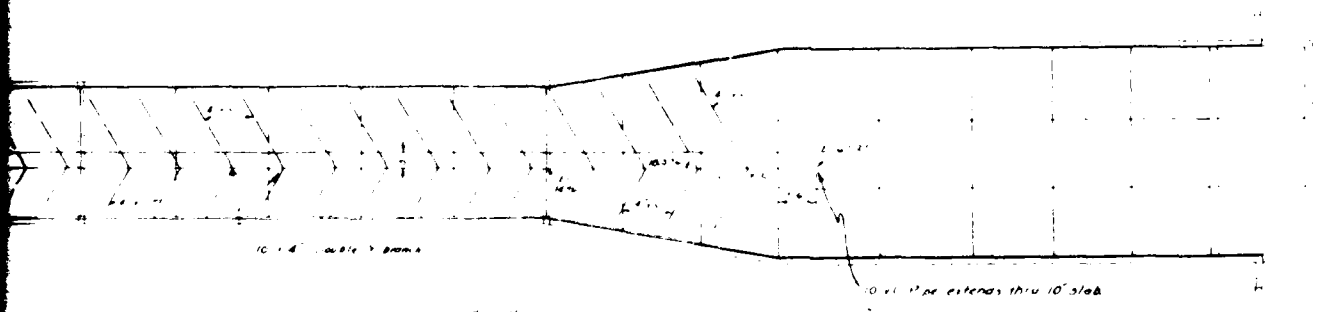


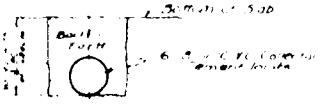


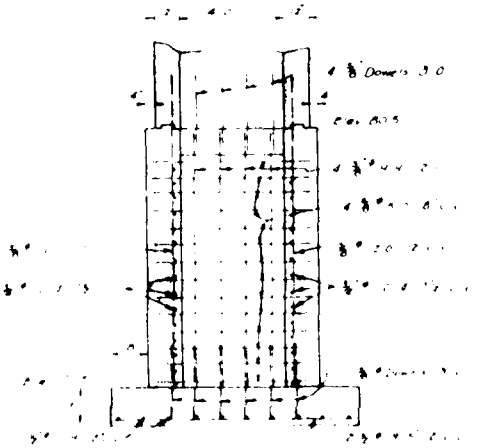


SECTION S S









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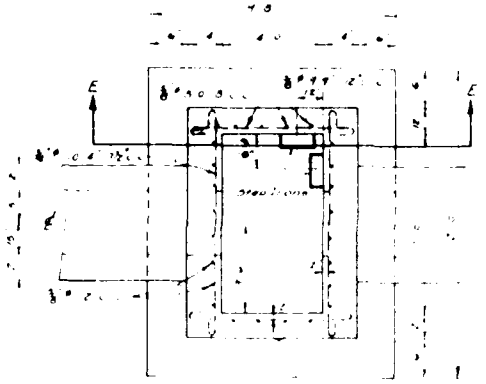

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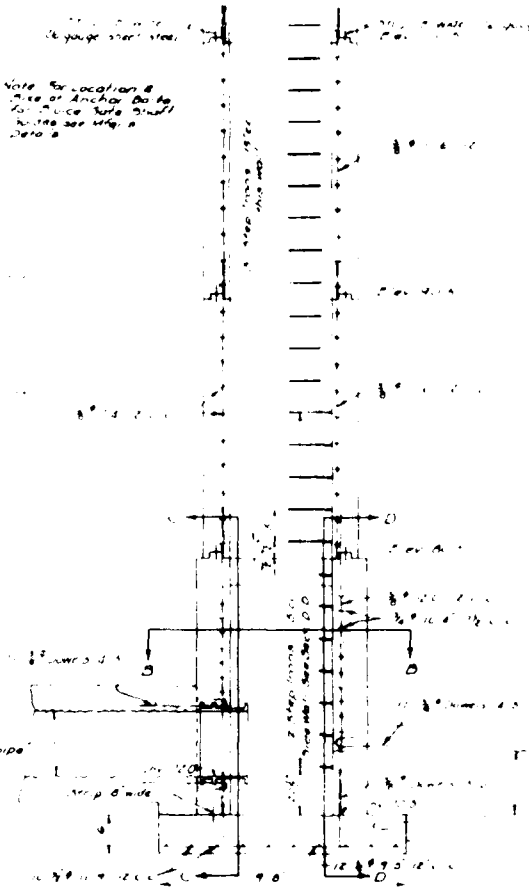
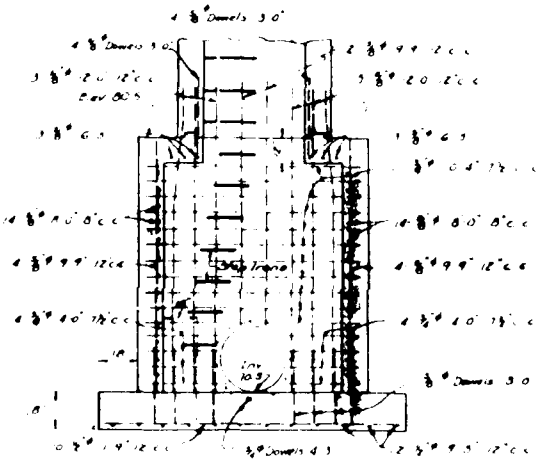


VERTICAL SECTION GATE TOWER



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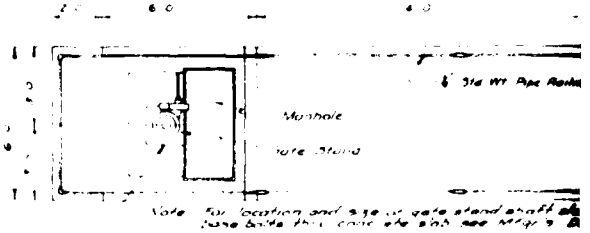
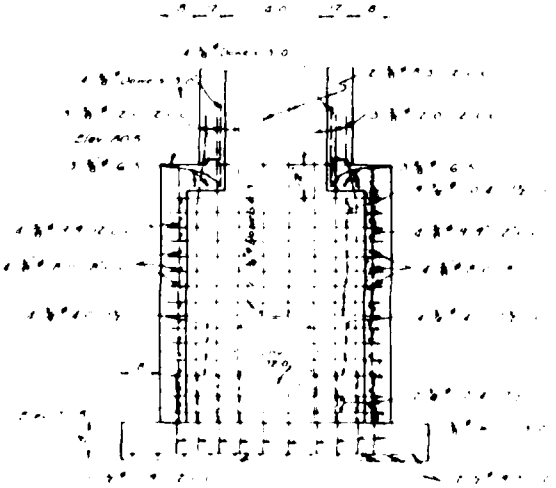


TOP VIEW TOWER & SPILLWAY



PALINGTOWN DAM
AND
RESERVOIR

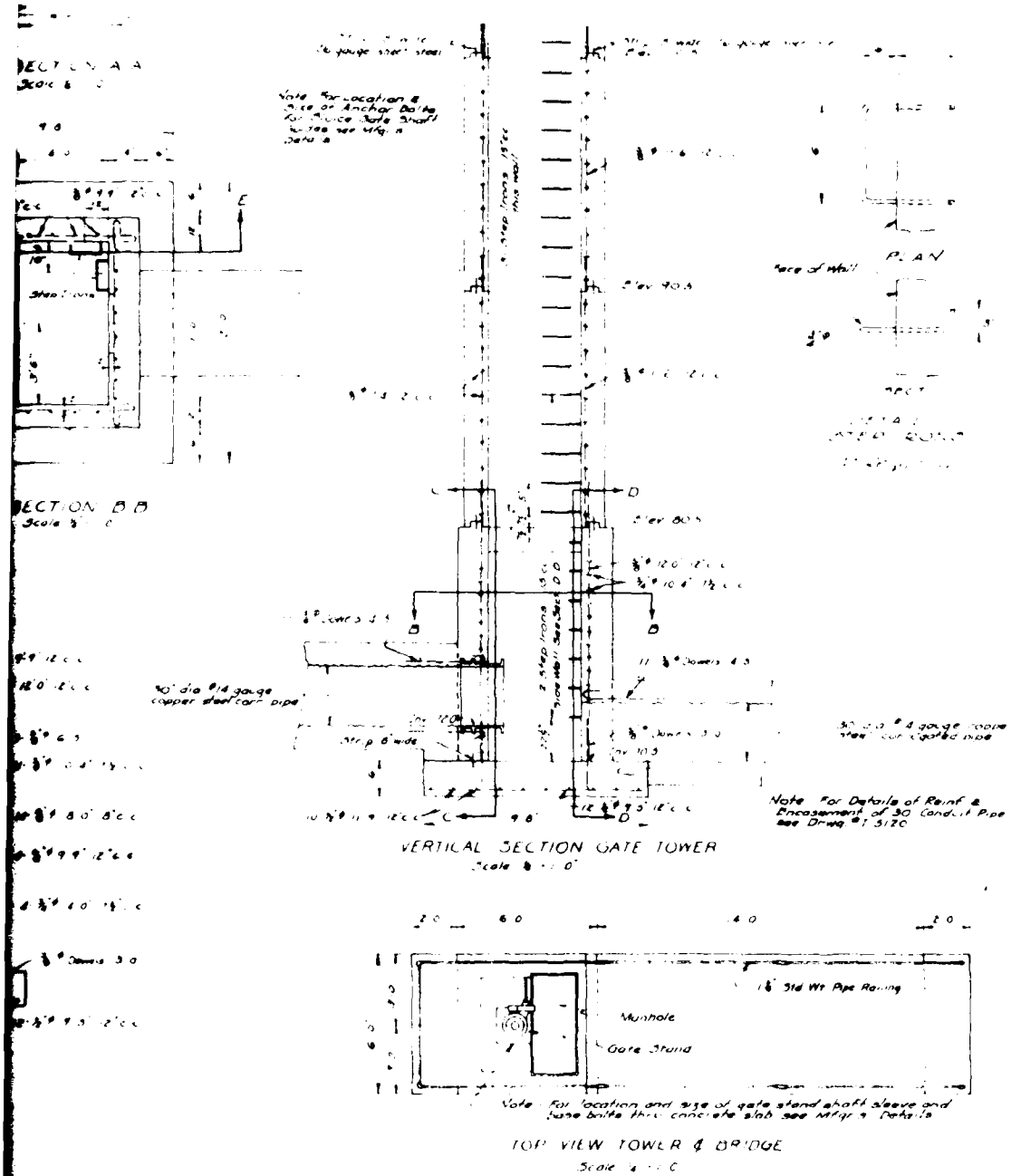
P. H. GLATFELTER C

SPRING GROVE PA.

SCALE AS SHOWN

GANNETT EASTMAN & FLEMING IN

HARRISBURG PA



VERTICAL SECTION GATE TOWER
Scale

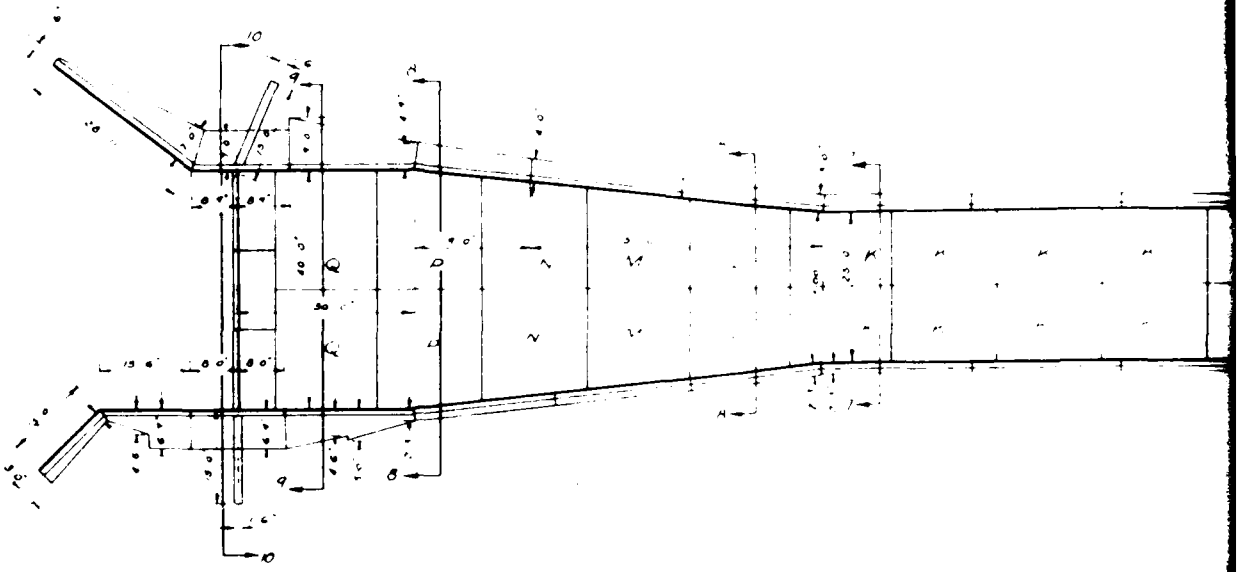
TOP VIEW TOWER & BRIDGE
Scale

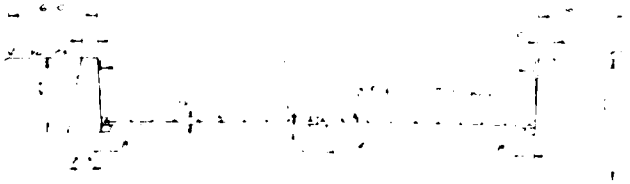
PALINGTOWN DAM
AND
RESERVOIR
P. H. GLATFELTER CO.
SPRING GROVE PA

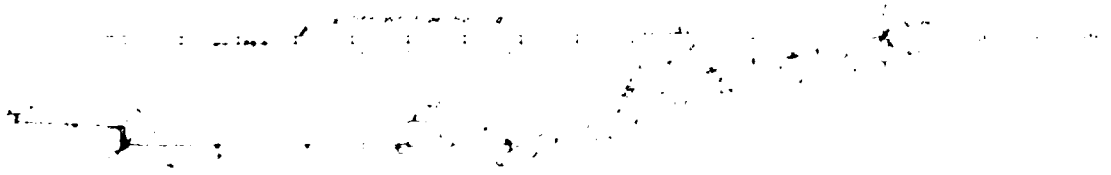
SCALE AS SHOWN FEB 1942

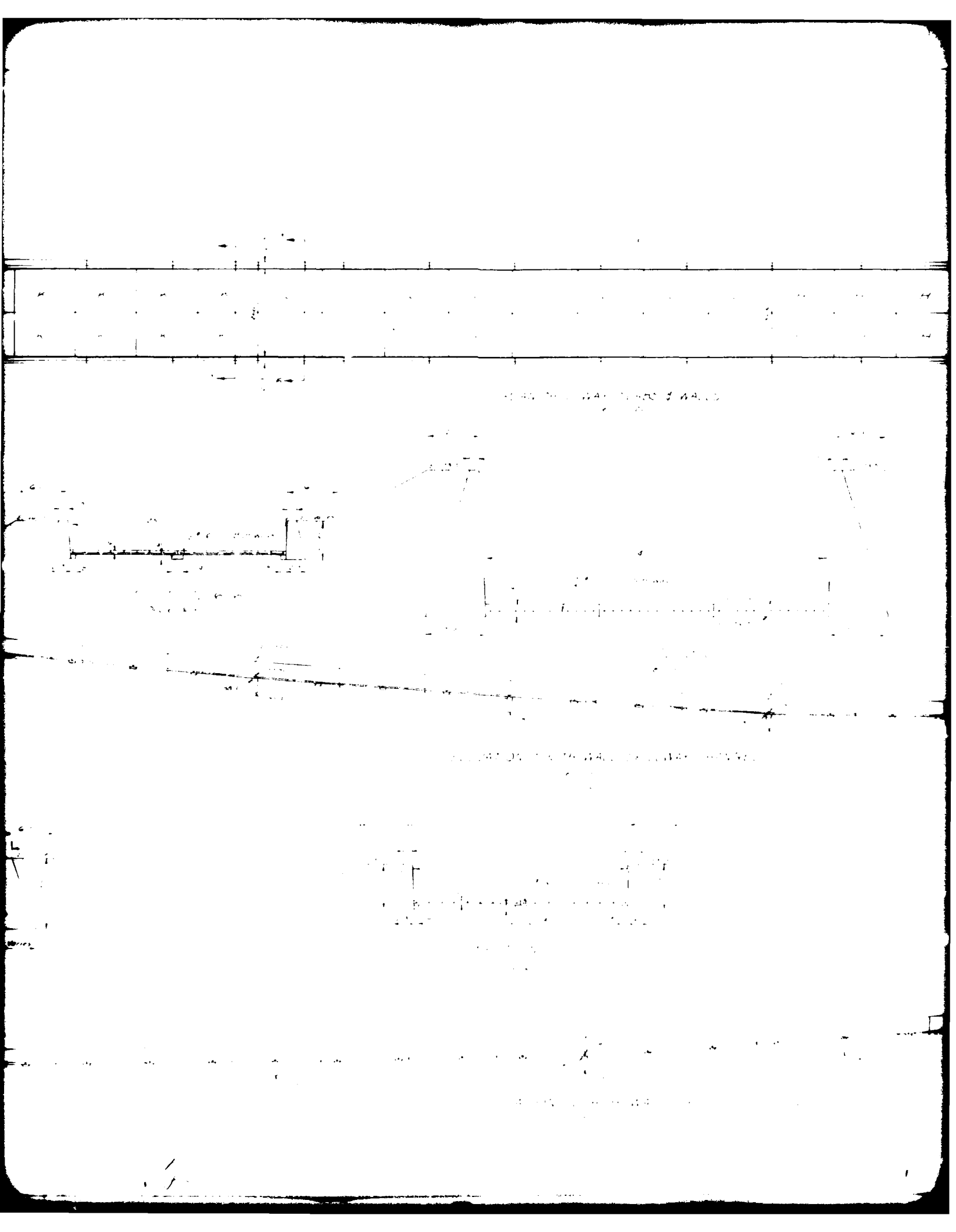
GANNETT EASTMAN & FLEMING INC ENGRS
HARRISBURG PA

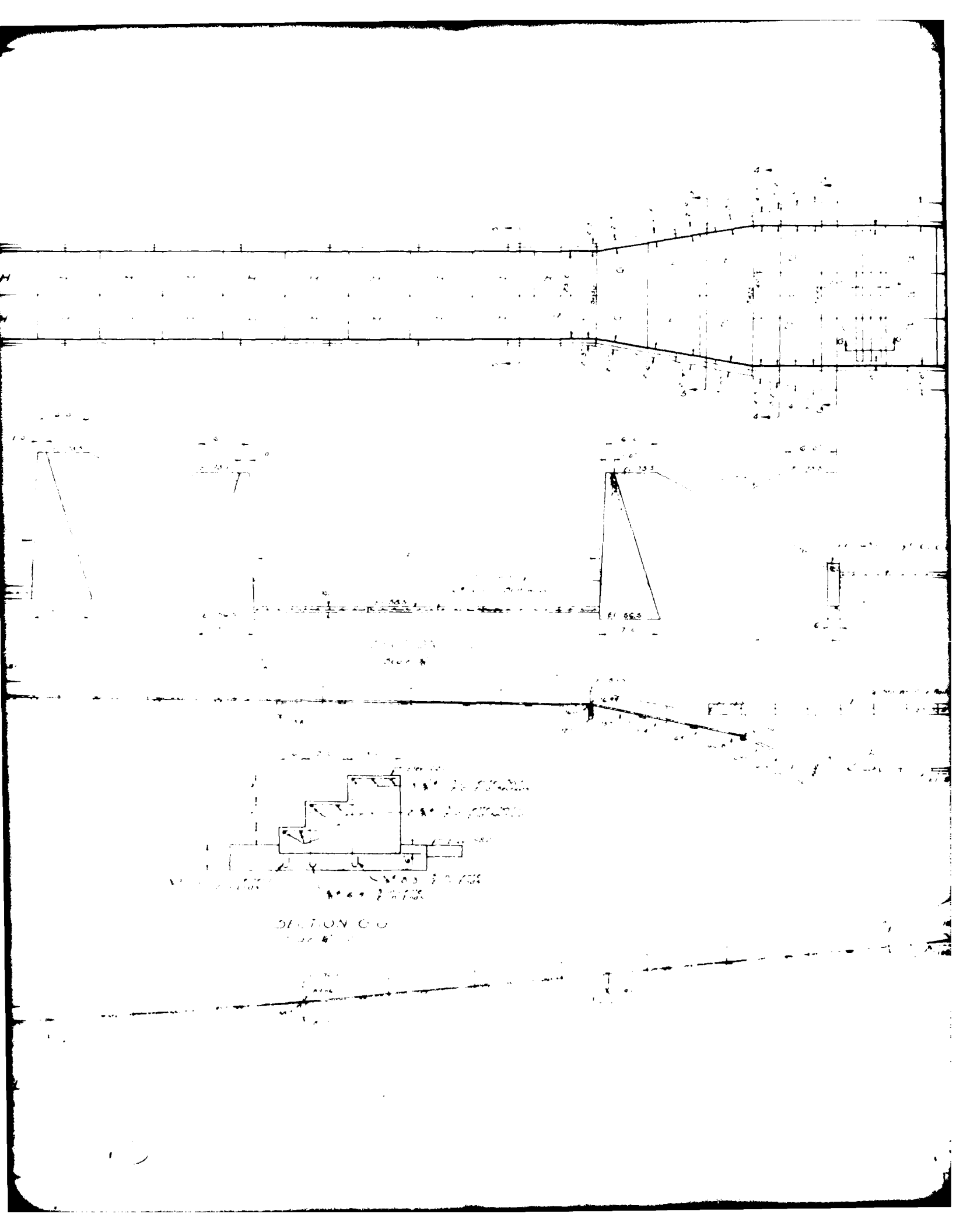
PA-00341
PLATE V

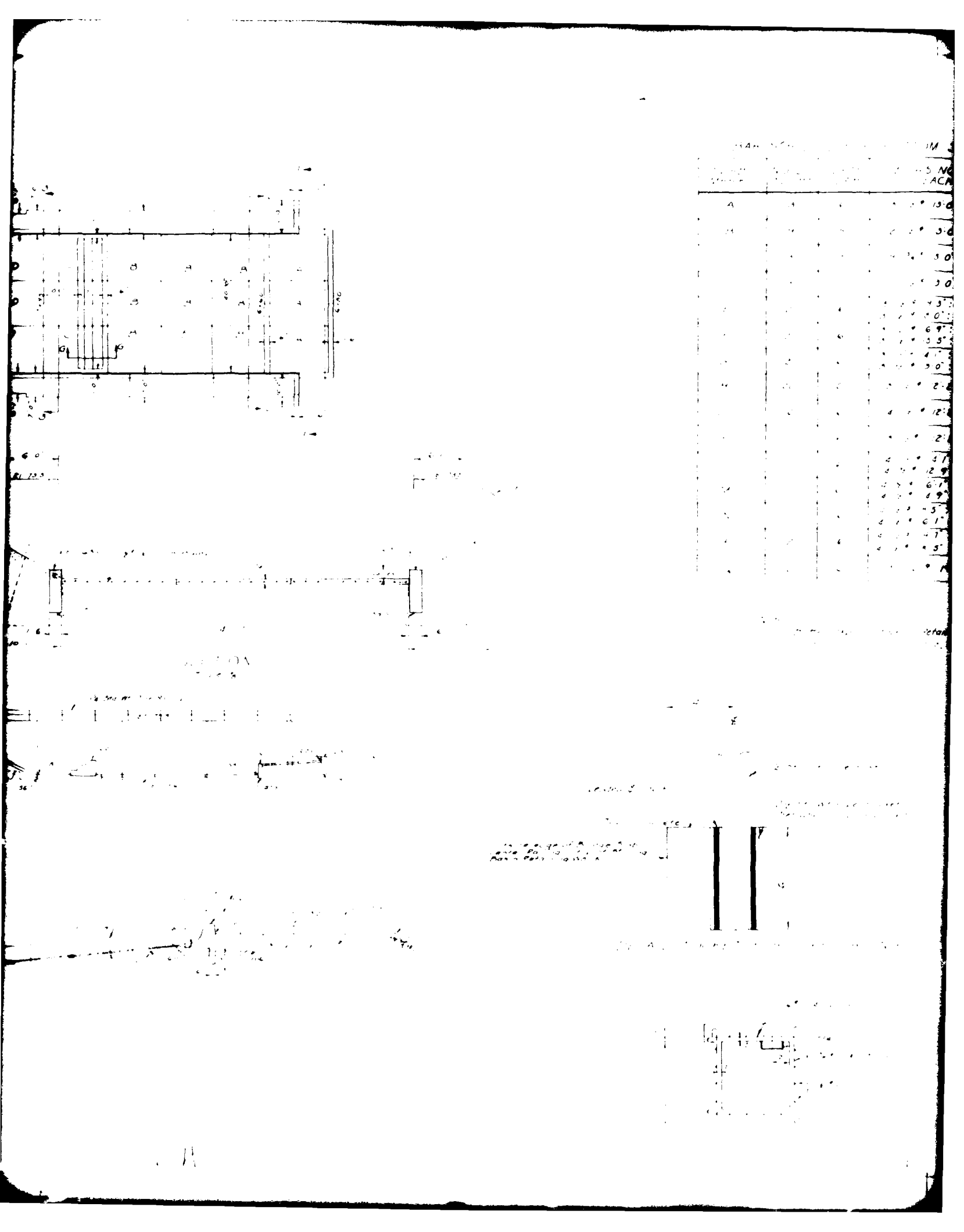


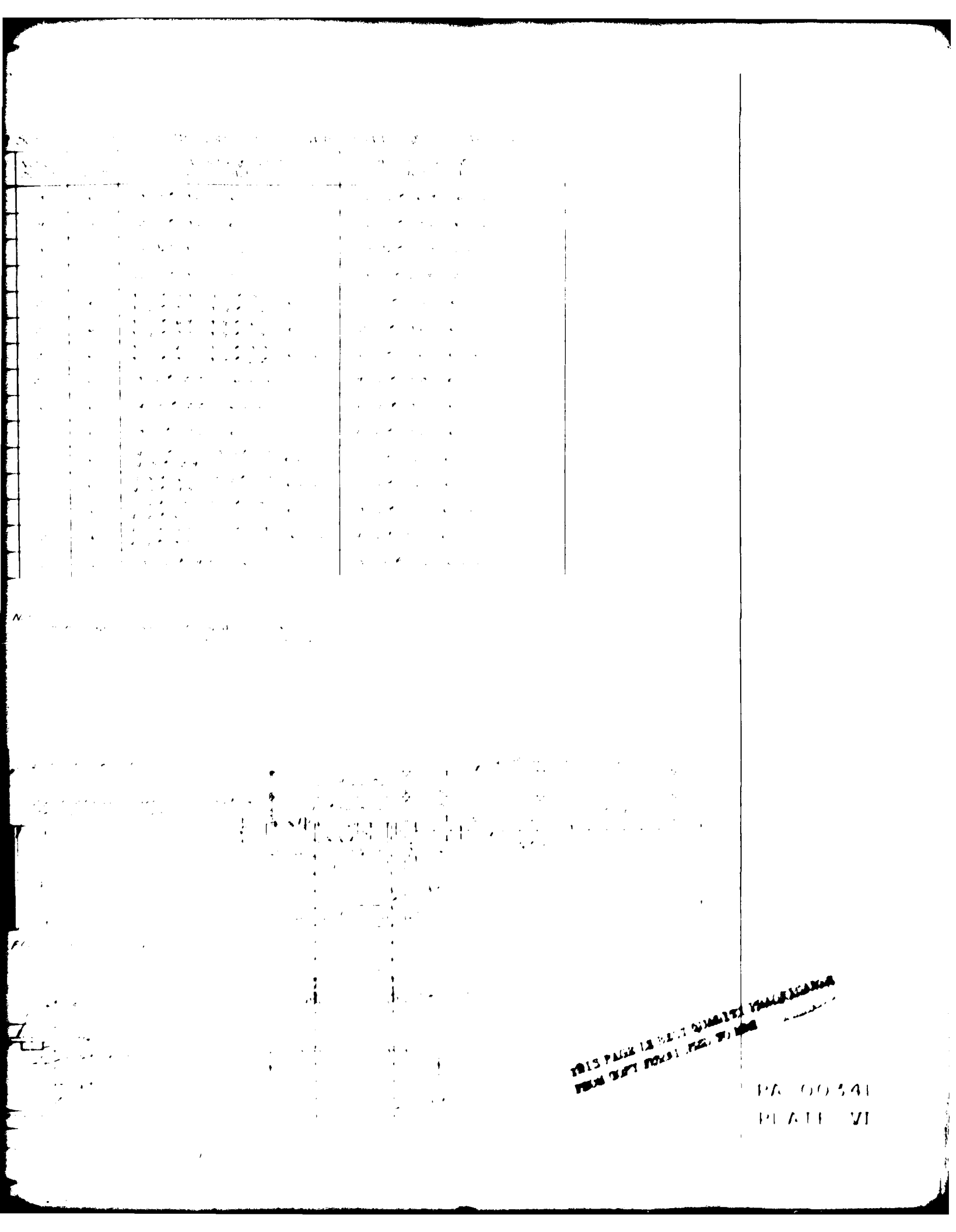












PA-00341
PLATE VII

AD-A097 346 BERGER ASSOCIATES INC HARRISBURG PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM, LAKE LEHMAN DAM (NDI NUMBER PA--ETC(U)
FEB 81 H JONGSMA DACW31-81-C-0013
UNCLASSIFIED NL

APPENDIX F

GEOLOGIC REPORT

GEOLOGIC REPORT

BEDROCK - DAM AND RESERVOIR

The reservoir area overlies two major formations, the Harpers and the Chickes formations. The dam itself is over the Harpers formation. This formation consists of dark gray, fine grained, quartzose phyllite, with interlayered, dense, green ferroginous quartzite and magnitite bearing gray quartzite.

STRUCTURE

The characteristic structure of this formation is close spaced, well developed cleavage and joint systems which dip steeply.

OVERBURDEN

The overburden in this area consists of two well drained loams, the Chewacla silt loam (Ck) and the Manor Channery loam (MfC2). The average depth to bedrock for the chewacla silt loam is 4-6' and for the manor channery loam, 2-4 feet. The formation is only moderately resistant to weathering and often produces a zone of highly fractured rock between the natural overburden and sound bedrock.

AQUIFER CHARACTERISTICS

Like all shistose formations, the harpers formation yields little water. The median yield is 14 gpm and it has a permeability of 0-6 feet per day. Subsurface seepage should be of little concern with this formation except in the weathered zone.

DISCUSSION

From the available plans, it is assumed that the main trench of the dam was excavated to bedrock. If this is the case, the harpers formation provides for a good foundation base. However, since the Harpers formation is only moderately resistant to weathering and complete break-up of the rock occurs frequently, this weathering could result in a zone more susceptible to water transport. Reports indicate that a concrete core wall was keyed in the underlying rock.

SOURCES OF INFORMATION

1. Hall, George M., 1932. Ground Water in South Eastern Pennsylvania: Pennsylvania Geological Survey W-2.

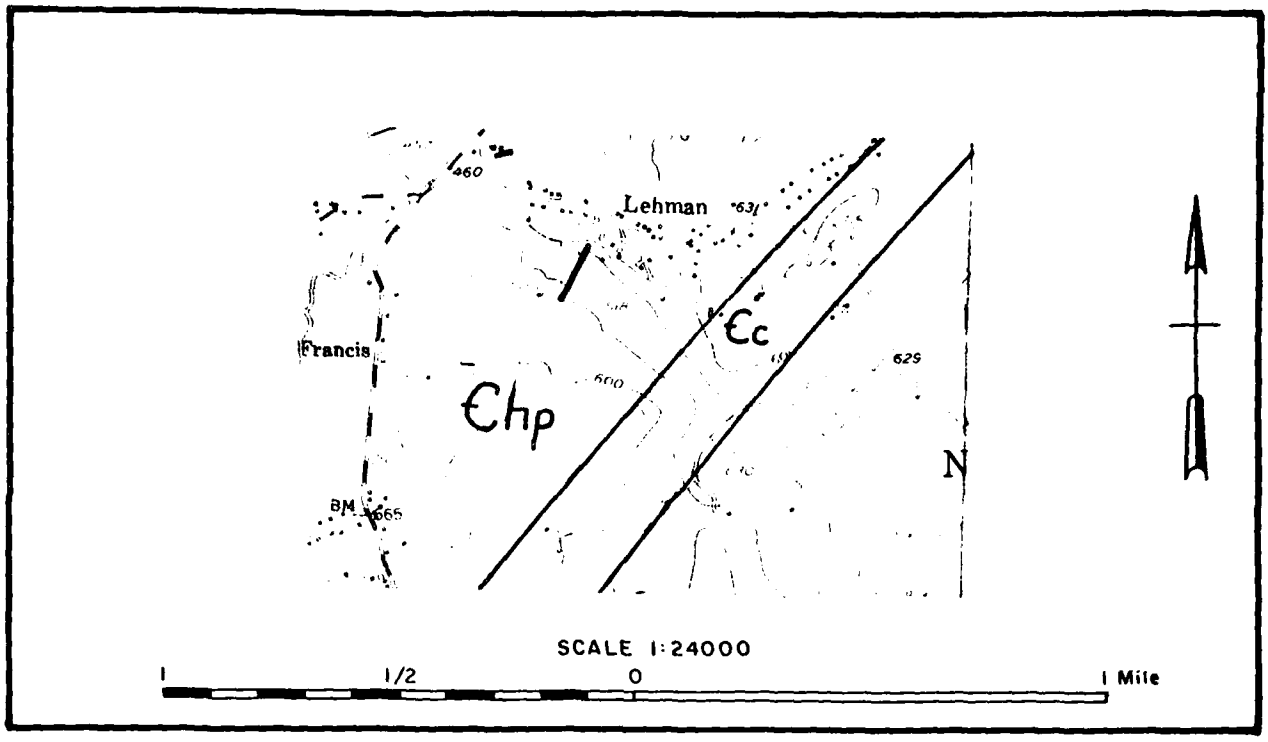
2. Lloyd, O.B., and Growitz, D.J., 1977. Ground Water Resources of Central and Southern York County, Pennsylvania: Pennsylvania Geological Survey W-42.

3. Wilshusen, J.P., 1979. Environmental Geology of the Greater York Area, York County: Pennsylvania Geological Survey EG-6.

4. Soil Survey, York County, 1963. United States Department of Agriculture.

5. Ashley, G.H., 1942. Report of Conditions at the Dam Site South of Spring Grove, York County, Personal Investigation.

GEOLOGIC MAP - LAKE LEHMAN DAM



LEGEND

Chp	Harpers Formation
Cc	Chickies Formation